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Electrical Construction and Maintenance

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Outlook for 1959

Appraising the prospects for electrical construction activity this year. page 67

Pressurized Control Center

Industrial controls and motor-generator in dust-free area operate copper tube mill. page 69

World's Brightest Street Lighting

Chicago's State Street relighting uses new high intensity fluorescent system. page 75

School Fire Detection

Fully automatic fire detection and alarm system guards Rochester school. page 80

and remember

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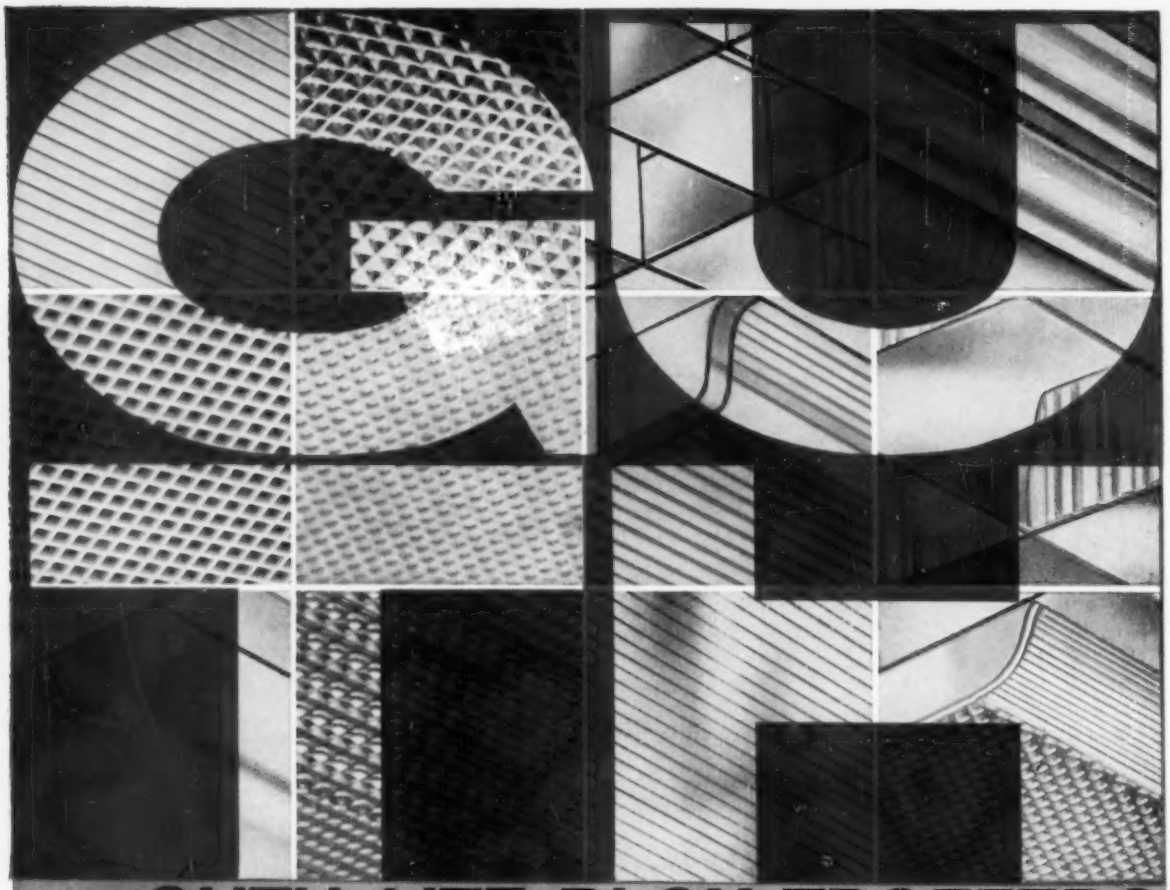

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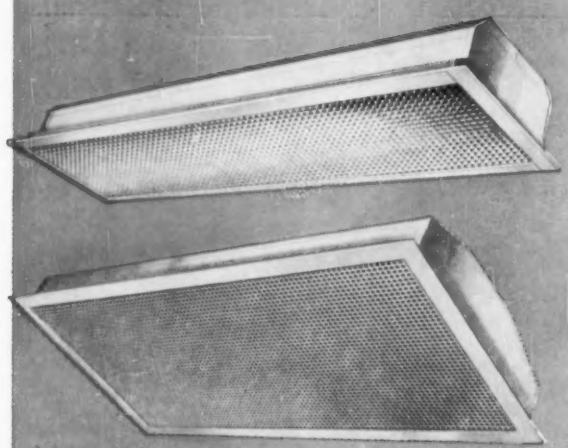

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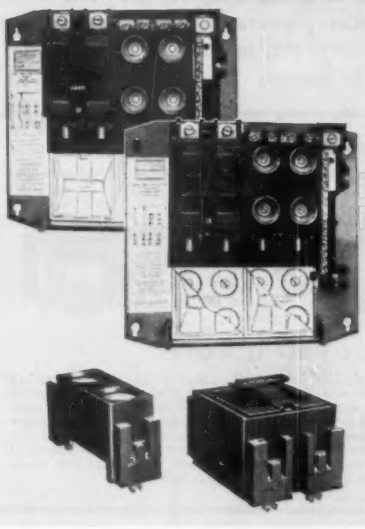

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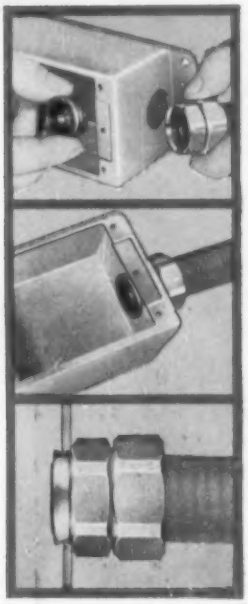

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Electrical Construction and Maintenance

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Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

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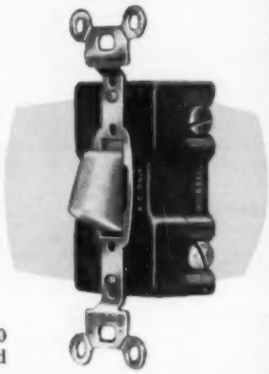

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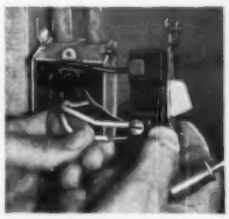

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engineering news

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Engineering Department

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subject:

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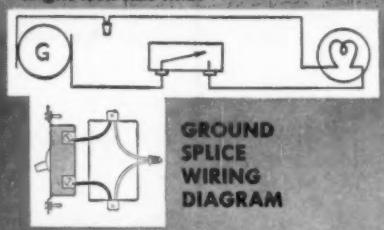
We will assume that we have only three elements to connect: 1) a power source, 2) a light and 3) a switch. In the ordinary installation we would connect one side of the line to the switch using the binding screw terminals provided. But, the other side of the line would be twisted together, possibly taped and fastened with a solderless connection. A diagram of this connection might look like this:



GROUND SPLICE WIRING DIAGRAM

After the connections are made, the whole tangle of wires is forced back into the box. Of course, there is nothing really wrong with this procedure except that it is messy, slow and crowds the box unnecessarily. On the other hand, how much quicker, easier and neater it would be if there could be an extra terminal, electrically dead with respect to the switch, to which the thru-feed side of the line could be fastened to make the splice.

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Washington Report

JANUARY • 1959

Continued business growth is forecast for 1959 by most Washington officials, based on a reasonably favorable existing economic climate as the new year begins. Continued recovery in housing, and auto sales, would bolster this growth, help insure another record year. But worry over inflation and over the wage-price spiral grows stronger. These will be studied in depth by the new Congress.

Industry leaders also forecast continuing fair business, but see no strong signs of either a boom or a serious setback in recovery from last year's economic decline. Forecasters generally agree consumers will pay more for almost every type of product, as a result of higher wages and higher costs for production materials. Here are some of the specific industry forecasts: steel—115 million tons output, compared with some 85 million tons last year; autos—5.5 to 6.0 million for 1959, up one or more million from 1958; construction—$52 billion expenditures this year, with the major advance in public funds spending, up about $3.5 billion from last year; retail sales—about $305 billion, compared with $290 billion in 1958.

New construction spending last November topped $4.4 billion, compared with $4.2 billion in November of 1957; also, this was a less-than-seasonal decline from the October $4.8 billion level, Commerce and Labor Depts. reported. Total for first 11 months of last year was nearly $45 billion, topping the $44.3 billion for the similar 1957 period.

Homebuilding showed remarkable vigor during the last half of last year. Starts for this period are expected to total about 650,000, about the same as in 1954, better than in 1955, and only 40,000 starts short of 1950's record 690,000 for the last-half-year period. Housing starts last November totaled 102,000, for a seasonally-adjusted 1,330,000 annual rate, highest for any month in three years, or for any November in four years.

Electricity output hit record highs last December, when total weekly kwh production climbed above 13 billion for a rate of about 5.7% ahead of similar periods a year earlier. Increased industrial activity plus cold weather were contributing factors.

Man-days lost due to strikes skyrocketed in 4th quarter of last year, with October alone accounting for 5,250,000, highest for any October since 1949. Three hundred new strikes were begun in October, bringing total work stoppages in effect that month to 525. Losses for November and December, not yet available, are expected to be considerably higher than normal for these months.

National economy statistics bolster business optimism, provide guidelines to overall activity, but must be kept in proper perspective for impact on specific industry business activity. Here are some of the latest available:

- **Gross National Product** annual rate in 4th quarter 1958 was $453 billion, up $14 billion from 3rd quarter.
- **Personal income** hit a new high of $360 billion in November, is expected to total $353 billion for 1958.
- **Industrial production** rose to 141% (1947-49—100), in November, up 3% over October, 2% over November 1957, and only four points below record high of 145% in August 1957.
- **Cost of Living** climbed to 123.9% of 1947-49 average in November, highest in history.

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Sidelights

BIG YEAR AHEAD

Prospects that new construction will set new records in 1959 and possibly break through the physical volume peak of 1955, together with the accelerating demand for electrical modernization in existing buildings are expected to lift electrical construction activity by 10% or more in the coming months. The impact of new illumination standards and a substantial pick-up in electric heating activity are further plus values which should build a favorable business year for electrical construction, installation and maintenance operations. See "Outlook for '59" which opens our editorial feature section on page 67.

BRIGHTEST STREET LIGHTING

Chicago's famous State Street, world-famous shopping area, greeted Christmas shoppers last month with the world's brightest street lighting. New four-luminaire street lighting standards equipped with power-groove fluorescent lamps establish unprecedented illumination levels along the business artery through the heart of the "Loop". Installation of the system on busy streets which could not be blocked off presented many problems in planning and scheduling. Mort. J. Glenner and Joseph Chaput of Commercial Lighting Co., electrical contractors for the unique project, describe the system and its installation in "World's Brightest Street Lighting" beginning on page 75.

SCHOOL FIRE DETECTION

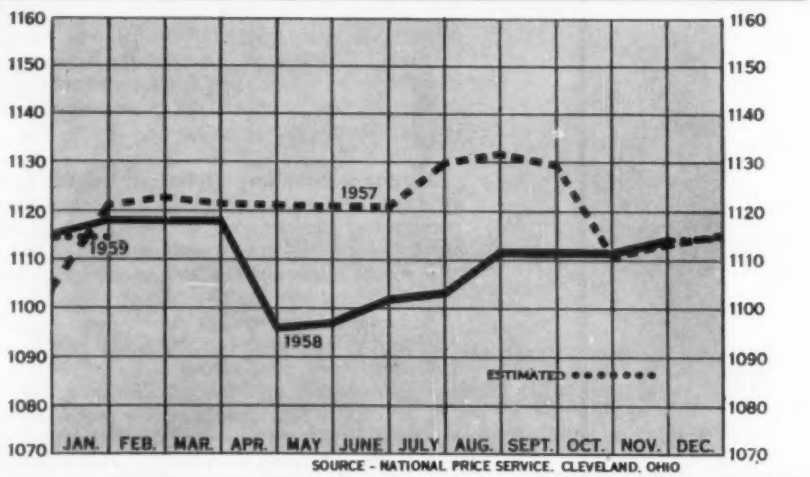
Last year Editor Bill Stuart paid a quick visit to his old home town to inspect an interesting automatic fire detection system installed by Conlang Electric Co. in one of Rochester's older school buildings. The proceeds of that visit, "Fire Detection for Rochester's P. S. 17" beginning on page 80, was written before anyone imagined that a delay in discovering a school fire and sounding the alarm would lead to the recent stunning disaster in a Chicago parochial school. Automatic fire warning systems are now very much in the news as fire prevention specialists and school authorities are reviewing their fire safety facilities.

DUST-FREE CONTROL CENTER

Centralization of switchgear, relays, contactors and motor generator sets for the operation of a large copper tube mill in a sealed room with air supplied under positive pressure through a filter system provides a dust-free environment and reduced maintenance. The installation is described by Henry W. Kragh, Asst. Chief Electrical Engineer, Wigton-Abbott Corp., in "Pressurized Control Center" beginning on page 69.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



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NuTone's Oven Hood Fan traps the scorching heat when oven door is opened.

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when oven door is opened.

See next page

A MESSAGE TO AMERICAN INDUSTRY • ONE OF A SERIES

Industry Moves Ahead with Plan '59...

To modernize now for growth and profits

The most expensive task to be performed in America, in this new year of 1959, is the modernization of our industrial plant and equipment. This is true despite the huge expenditures on new facilities made in the past decade.

Contrary to popular opinion, and even to much learned opinion, our industrial facilities are not up to date. In a special survey conducted in August 1958, and supplemented by further interviews since that time, the McGraw-Hill Department of Economics found that it would take $95 billion to bring all our plant and equipment up to the best modern standards. This is over $15 billion more than the record budget of the U.S. government for the coming year.

How did we get so far behind? It is true that business has made record capital expenditures in recent years, but most of this investment has been to expand capacity. And in concentrating on new capacity, industry has fallen behind on the modernization of older facilities. Meanwhile, the $8 billion a year surge of research and development has brought forth new machines and new processes, at a rate that makes prewar and even early postwar equipment badly obsolete.

The lag between what research has promised —especially in more efficient tools of production —and what has actually been accomplished up to now shows clearly in the AMERICAN MACHINIST inventory of metalworking equipment for 1958. This new study, covering 167 types of equipment in 5,800 metalworking plants, shows that three out of five metalworking machines are over ten years old. This is a startling indication of how obsolete many plants have become. A 1958 machine tool is 54% more productive than one purchased in 1948. Many of the tools industry now uses are actually of 1939, or earlier, design.

Investment Starts Up

Now industry's plans for 1959 show a new awareness of the need to modernize. In its surveys, conducted during the last part of 1958, the McGraw-Hill Department of Economics discovered these facts:

(1) Companies generally believe that a larger investment in modernization will

rid of damp moisture condensation
. . avoid lingering bathroom odors.
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mean more profits—soon. Most of the manufacturing companies in the surveys expect their current modernization expenditures to pay off in less than five years. With labor costs rising steadily, it is only with better, more modern equipment that most companies can hope to make these profit gains.

(2) Industry's plans for modernization have been revised upward. Total plans for 1959 investment, in new plant and equipment, now come to $33 billion—compared with $31 billion reported earlier. And most of these new plans are directed toward modernization—installing new processes or making ready for new products, developed out of the most recent scientific advances.

It therefore seems clear that modernization expenditures in 1959 will rise enough to make an impressive start on the job of updating our plant and equipment. But it will be no more than a start. Research also is moving ahead with giant strides. Plant expenditures must increase rapidly, from 1958's low level, to win the battle against obsolescence.

How Can We Modernize Faster?

What can we do to accelerate industry's new drive for more modern plant and equipment? One aid will be an improved flow of technical information on how, and where, to modernize. With this purpose, the McGraw-Hill Publishing Company several months ago inaugurated PLAN '59, a joint effort by all its magazines to spotlight the best opportunities for modernization. During 1959, McGraw-Hill publications will continue this effort by putting special emphasis on new developments in plant and equipment.

On the key problem of financing modernization—the question "Where's the money coming from?"—the McGraw-Hill Department of Economics plans several new studies in the months ahead. The first of these will deal with the number one problem in financing: the need for adequate depreciation allowances. Such studies are a small, but we hope a helpful, part of the total effort that is needed to modernize American industry.

An Individual Effort

The really vital steps in modernizing must be taken by individual companies. The backlog of obsolete plant and equipment is widely dispersed, among firms of all sizes and in all areas. It cannot be wiped out by dynamic equipment policies on the part of a few leading firms. Not just a few, but thousands of industrial companies must take inventory of their respective equipment and compare it, case by case, with the best new machines available.

Finally, there is need for increased public recognition of the modernization problem, and for federal tax policies appropriate to a period of rapid technical change in business.

The most important point is that the modernization drive has begun. This start can accelerate, with intelligent business and public policies, to give us truly modern industrial facilities. Plant and equipment expenditures are finally beginning to reflect the stepped-up pace of research and development. This can be a major factor in renewed economic growth and prosperity as we move into 1959.

This message was prepared by the McGraw-Hill Department of Economics as part of our company-wide effort to report on opportunities for modernization in industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

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Now you can make accurate bids and *know exactly* what your profit will be when you install Electrostrip — the finest, safest multi-outlet assembly on the market.

Electrostrip surface mounts quickly, easily on walls or woodwork . . . and shapes readily to fit the contour of any room. The 100-foot and 250-foot coils and fittings are packaged for easy handling . . . give you a complete installation with a minimum number of items. For no more than the cost of fixed outlets, you now can provide your customers with complete freedom of receptacle locations.

Electrostrip outlets can be positioned wherever convenience dictates.

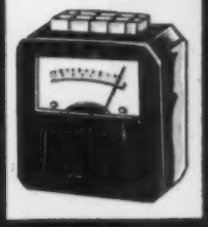
For residential or commercial installations, for new construction or modernization, you're way ahead when you recommend and install Electrostrip. U/L approved. © BEPCO

BULLDOG

BullDog Electric Products Company, Division of I-T-E Circuit Breaker Company, Detroit 32, Michigan. *BullDog Export Division:* 13 East 40th Street, New York 16, New York. *In Canada:* BullDog Electric Products Co. (Canada) Limited, 80 Clayson Road, Toronto 15, Ontario.

NEW Dimensions For The Foot Candle!

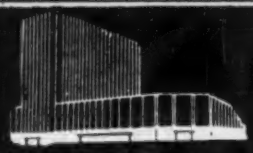
2nd NATIONAL LIGHTING EXPOSITION



THE ONLY COMPLETE LIGHTING SHOW IN AMERICA

for engineers, architects, designers, distributors, decorators, contractors and others.

NEW YORK COLISEUM
MARCH 1, 2, 3, 4—1959
MORE EXHIBITS...over 200...



covering a complete cross-section of Lighting Manufacturers.

SYMPOSIUMS:

MONDAY, MAR. 2, 1959

1) 10-11:30 A.M.—Where Are We Going in Lighting?
2) 11:30-12:15—Office Lighting
3) 1-2 P.M.—Street & Highway Lighting
4) 2-3 P.M.—Light & Architecture

TUESDAY, MAR. 3, 1959

5) 10-11 A.M. Institutional Lighting (Banks, Public Bldgs., Schools, Hospitals)
6) 11-12 noon — Lighting for Selling (Dept. Stores, Super Mkts., etc.)
7) 12:45-1:30 P.M. — Polarization — its Relation to Lighting
8) 1:30-3:30 P.M.—The Blackwell Report

WEDNESDAY, MAR. 4, 1959

9) 10-11 A.M.—Residential Lighting
10) 11-12 noon—Industrial Plants & Factories
11) 1-2 P.M.—Outdoor & Recreational Lighting
12) 2-3 P.M.—Theatre & Television Lighting

MORE SYMPOSIUMS and PANEL DISCUSSIONS . . .

conducted by **45** nationally acclaimed experts!

SYMPOSIUMS BY RESERVATION ONLY—due to limited seating capacity. CHECK THOSE YOU WANT TO ATTEND & MAIL COUPON PROMPTLY. YOUR RESERVATION TICKETS WILL BE WAITING FOR YOU AT THE BOX OFFICE.

PLUS

SPECIAL EVENTS:

Opening Day — Sunday, March 1 — 12:30 P. M.

GEORGE J. TAYLOR — Pres. of the Illuminating Engineering Society — will deliver the key-note address.

For Everyone who Sells Lighting . . .

Twice daily showing of the Academy of Lighting Arts' film—"How to Sell Lighting"—in our specially built theatre.

Special Educational Exhibits . . .

including a fascinating display on "History of Lighting".

2nd NATIONAL LIGHTING EXPOSITION, Dept. EC
550 5th Avenue, New York 36, N. Y.

name_____

firm_____

address_____

city_____ state_____

I wish to attend Symposiums (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12)

MAIL TODAY!

EXHIBITS OPEN AFTERNOONS & EVENINGS

NO CHARGES! NO FEES!

EXCLUSIVELY for the TRADE — by invitation only

sponsor **LLEMSA**
Lighting, Lamps & Electrical Manufacturers Salesmen's Assoc., Inc.

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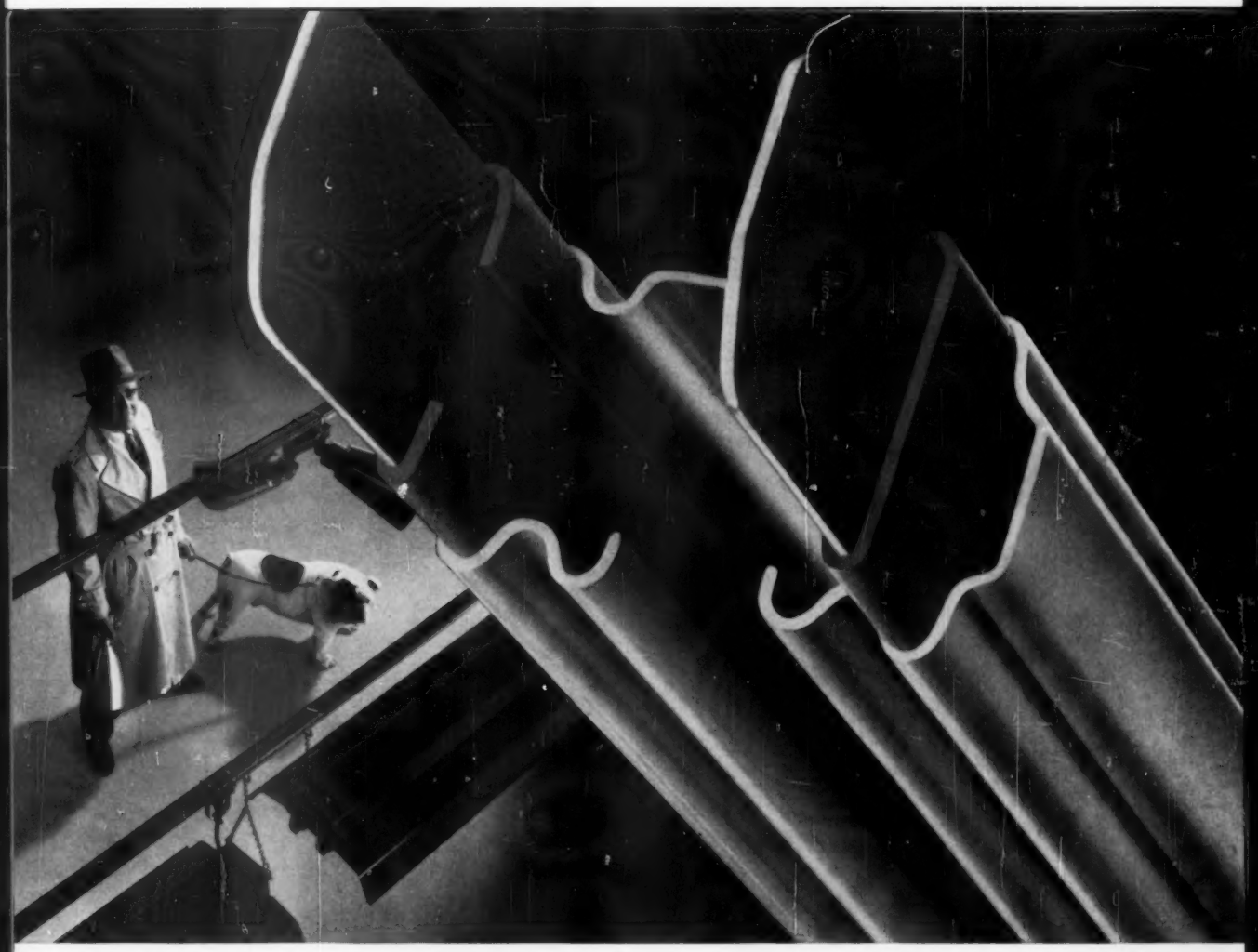
National Lighting Expositions, 550 Fifth Ave., N. Y. 36, N. Y. • phone: JUdson 2-6052



BIDS ALWAYS "ON THE NOSE" WITH UNIVERSAL LIGHTING DUCT

Exclusive BullDog features mean faster, easier installation that keeps costs competitive

Nothing makes it harder to figure lighting bids (particularly pipe and wire) than those unexpected—and expensive—changes you always run into after the job is started.

BullDog 20-amp Universal Lighting Duct licks that problem completely. You know in advance your final material and labor costs. So you can figure estimates—and profits—right "on the nose" before the job begins, instead of after it's over.

Changes in lighting arrangements during installation present no problem since you can tap in anywhere along the entire length of Universal Lighting Duct. Moving outlet locations, or rearranging the layout, can be done without costly and time-consuming rewiring. With BullDog, you just move the exclusive "twist-out" plug to the desired new location in a matter of seconds.

ULD is actually less expensive to install than pipe and wire, too, because it offers so many time-saving features . . . such as prefabricated parts . . . easily joined sections . . . choice of five installation methods . . . and the fact that it both feeds and supports the fixtures, thus eliminating the need for extra supports.

Join the growing list of contractors making money — and keeping customers happy — with ULD. For details, write BullDog Electric Products Co., Detroit 32, Michigan. © BEPCO

BULLDOG

BullDog Electric Products Company, Division of I-T-E Circuit Breaker Company, Detroit 32, Mich. *BullDog Export Division:* 13 East 40th St., New York 16, N.Y. *In Canada:* BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

Sylvania announces a major break-through in fluorescent lighting

Now for the first time standard fluorescent lamps delivering . . .

Over **70** *lumens-per-watt in the popular 40-watt, 4-foot lamps*

Over **75** *lumens-per-watt in the 75-watt, 8-foot lamps*

This startling increase in lumen output means you get more light for the same power consumed than ever before. Yet this remarkable development in lighting performance has been achieved with *no* sacrifice in lamp life!

This impressive contribution to lighting efficiency comes from brilliant laboratory work by Sylvania engineers on phosphor structure and processing techniques. As a result, these higher lumen ratings are now available for the Sylvania standard eight-foot, 75-watt lamp and the popular four-foot, 40-watt lamps. Very soon all other popular Sylvania lamp types will have similar higher ratings.

Check your Sylvania Representative immediately for full details about this extraordinary development and learn why —more than ever—*Sylvania fluorescents give you more light at lower cost than all other brands!*

SYLVANIA LIGHTING PRODUCTS
Division of Sylvania Electric Products Inc.
Dept. 9L-8301, 60 Boston Street, Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd.
P. O. Box 1190, Station "O", Montreal 9

SYLVANIA Lighting Products

make light a better tool for profits

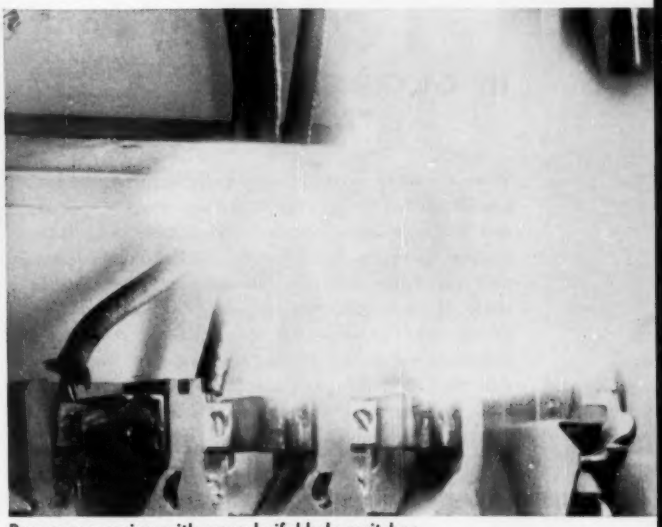
LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

FOR SAFETY'S SAKE, BUY VACU-BREAK

With BullDog's exclusive clamped-pressure switching contacts

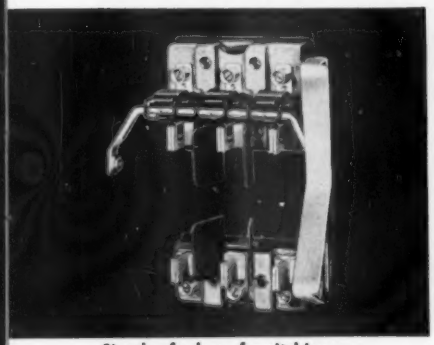
Maximum safety with BullDog Safety Switches

Arcs are smothered before they can cause fire hazard or damage to the switch because contacts are housed inside compact Vacu-Break* chambers. Pitting and burning of contacts are reduced to an absolute minimum—maintenance is virtually eliminated.



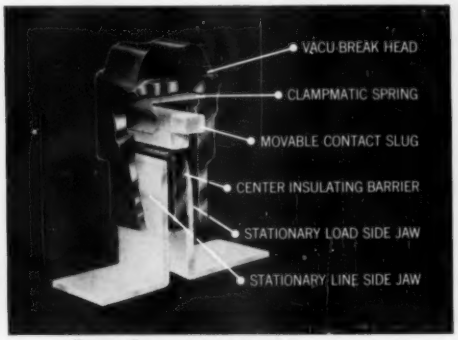
Dangerous arcing with open knifeblade switches

Unconfined flash explosion occurs, burning and pitting blades. Fire hazard and frequent maintenance are the result. These are unretouched photographs of 100 amp, 600 volt switches, operating under 90 ampere, 440 volt load with 40% to 50% power factor.



Simple, foolproof switching

Vacu-Break heads are *directly* connected to the switch handle. No toggles, triggers or springs to fail. No danger of switching failure. Positive, safe switching *every time* for a lifetime.



Clamped-pressure contacts

This close-up shows movable contact slug and Clampmatic* spring assembly inside Vacu-Break chamber. The Clampmatic assembly assures clamped-pressure contacts, speeds "break", increases switch life.

Withstand 100,000 amp fault current

BullDog Vacu-Break Switches—Master and Junior—will withstand 100,000 amp short circuit current when equipped with current-limiting Amp-Traps**. Play it safe—recommend and buy BullDog Vacu-Break!

© BEPCO

*Vacu-Break and Clampmatic are registered trademarks of the BullDog Electric Products Company.

**Amp-Trap is a registered trademark of the Chase-Shawmut Company.

BULLDOG

BullDog Electric Products Company, Division of I-T-E Circuit Breaker Company,
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In Canada: BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

New Lighting Combination

Installed by

Fischbach and Moore
Incorporated

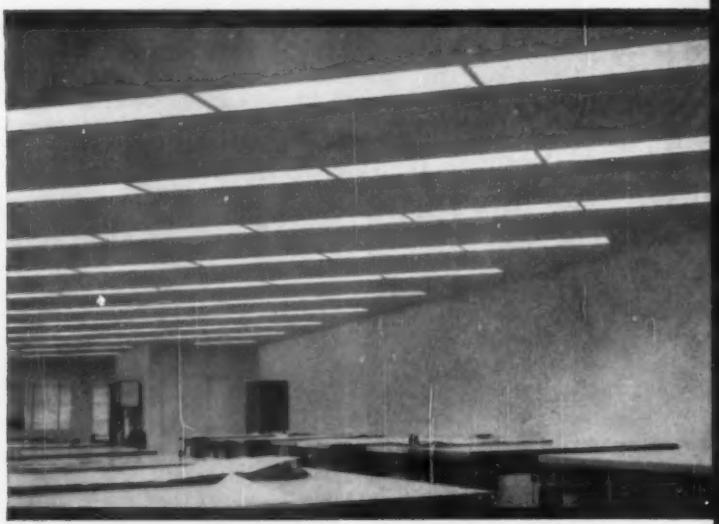
in their own quarters...

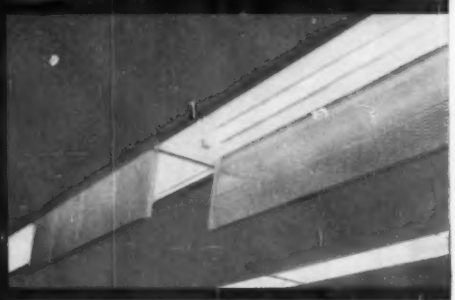
•

HOLOPHANE
Prismalume* Controlens*

in GLOBE
"Miracle-Door"† Troffers

When one of the world's foremost electrical contracting firms chooses specific lighting products for its own use—that's noteworthy! Fischbach and Moore, Incorporated, installed GLOBE "Miracle-Door" Troffers equipped with the HOLOPHANE Lo-Brite* Prismalume Controlens in their recently occupied New York quarters... The prismatic Controlens, made of crystal-clear acrylic plastic, is one piece, 4-foot long. It directs color-true, maximum illumination to vital areas, minimizing brightness and glare... Globe "Miracle-Doors" hinge open from either side; the "Hi-V" reflector plates are also reversible. This instant flexibility accommodates the partitioning requirements typical of today's modular construction... Send coupon today!





HOLOPHANE Company, Inc.
342 Madison Ave., New York 17, N. Y.

GLOBE Lighting Products, Inc.
16 E. 40th Street, New York 16, N. Y.

*® †Pat. Pend.

HOLOPHANE CO., INC., 342 Madison Ave., N.Y. 17
Please send us data on: Prismalume Controlens in Globe "Miracle-Door" Troffers.

INDIVIDUAL.....

ORGANIZATION.....

STREET.....

CITY..... ZONE..... STATE.....

When you buy Motor Starters--

YOU PAY FOR OVERLOAD PROTECTION

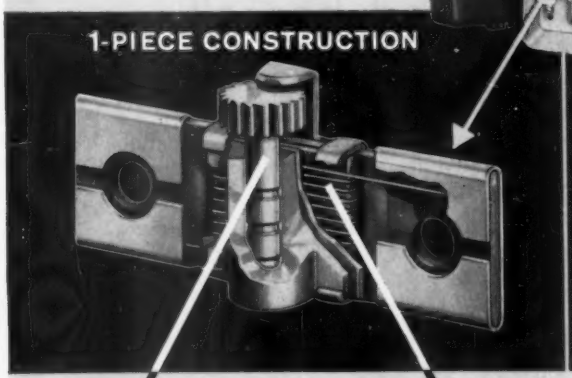
Only ONE-PIECE Overload Relays give 100% Protection • Only with ONE-PIECE construction can you *know* you've installed the heater correctly. Only with ONE-PIECE construction can you *know* the heater is exactly centered, or properly positioned, so that it performs according to its rating. Only with ONE-PIECE construction can you *know* your motors have full protection.

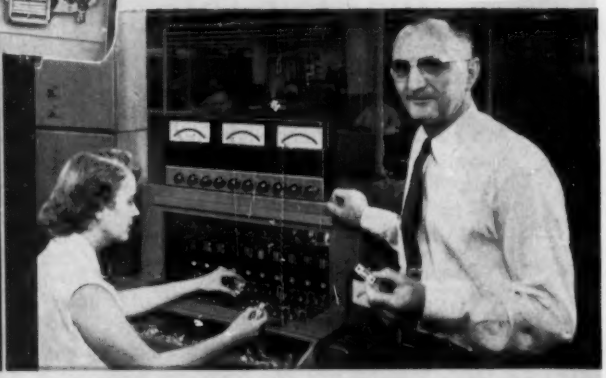
Only Square D has ONE-PIECE Construction • ONE-PIECE construction *eliminates* any possibility of heater misalignment. Square D melting alloy thermal overload relays can be installed only one way. They are tamperproof. They are factory-assembled, are *individually* calibrated and tested. Repeated tripping will not affect accuracy.

Insist on Square D melting alloy thermal overload relays

***Write** for Bulletin SM-275 for the complete story on Square D starters with ONE-PIECE thermal overload relays. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.*

...BE SURE YOU GET IT!





Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.

Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

Individual factory inspection of every Square D melting alloy thermal overload relay means performance you can trust. Each unit is calibrated and thoroughly tested to make sure it will perform according to its rating.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

Don Kilps discusses the planned telephone facilities of his 1958 "Parade" home with Al Braun, of Wisconsin Telephone Company. At right, he points out one of the 16 telephone outlets going into his own new home, now under construction.

"90 per cent of our prospects want a telephone-planned home"

—SAYS DON KILPS, CUSTOM BUILDER OF MILWAUKEE, WISCONSIN

"We build for discriminating buyers who want custom advantages in their homes," says Mr. Kilps. "So we provide plenty of telephone outlets—for portable as well as permanent phones —and with wiring fully concealed.

"Telephone planning is a first-rate sales feature. Prospects can see the virtues of hidden wiring and planning for growing telephone needs. In fact, 90 per cent of them comment on it. And, working with the telephone company, we find it costs us so little to offer it."

Mr. Kilps is General Chairman of Milwaukee's 1959 "Parade of Homes," which will feature exhibit homes by more than 60 registered builders in the area. His contribution to the 1958 "Parade" is shown above.

Wm. Kilps Sons build about 50 units a year in the $12,000 to $50,000 price range—and telephone planning is a feature of every one.

* * *

Your local Telephone Business Office will be glad to help you with telephone planning for your homes. For details on home telephone installations, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

BELL TELEPHONE SYSTEM

BUILDERS: *Attending the NAHB Convention in Chicago? Be sure to visit the Bell Telephone System exhibit, Conrad Hilton Hotel—booths 15 and 16.*

FREE!

THE ONLY PRACTICAL ON-THE-JOB TAPE CUTTER* IN THE INDUSTRY

- GET A QUICK, CLEAN CUT
- STOP WASTING TAPE
- END FUMBLING FOR NEXT CUT

FREE with every 66' roll of

SLIPKNOT NO. 7 PLASTIC TAPE

*Patented.

Write for free sample on your letterhead

PLYMOUTH RUBBER COMPANY, INC.

Makers of SLIPKNOT FRICTION TAPE

DIVISION 15

CANTON, MASSACHUSETTS

Photo courtesy Wheeling Steel Corporation, Wheeling, West Virginia (Benwood Works)

Wheeling Steel specifies...

Abolite uplight fixtures for extra eye comfort, economical high bay lighting

These Abolite uplight fixtures are mounted forty feet high, yet there's comfortable, glareless 32 footcandle average light throughout this high bay building. Light directed upward through the fixture's open top eliminates sharp contrasts by washing out dark background shadows. Glare is virtually eliminated by 35° lamp shielding.

Abolite's modern air-swept design also reduces maintenance costs. Air circulating through the fixture sweeps it clean of dulling dust.

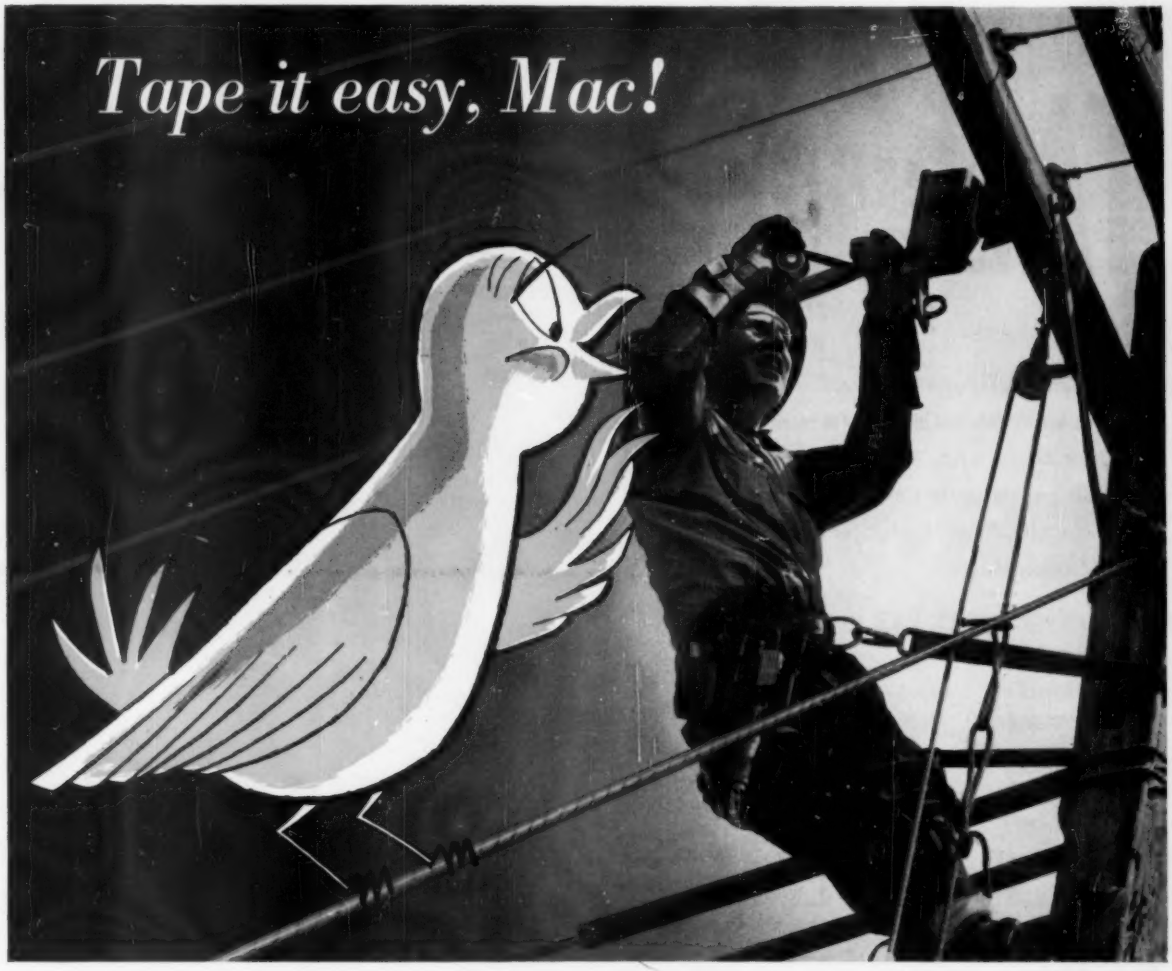
You can choose from several Abolite uplight units for high bay lighting: 18" and 24" diameter Alzak aluminum fixtures for use with 400 and 1000 watt mercury lamps and 14" and 18" diameter Alzak aluminum fixtures for 300-500 watt incandescent lamps (ideal for gymnasium lighting). For full information see Sweet's Industrial Construction File 12i/AB, or write *Abolite Lighting Division, The Jones Metal Products Company, West Lafayette, Ohio.*

INSTALLATION DATA:
Abolite Cat. No. HMFAU-2400 Alzak aluminum uplight fixtures with 400 watt white reflector mercury lamps. Mounting height 40' with 16' x 20' spacing. Average footcandle level: 32.

ABOLITE Lighting

THE JONES METAL PRODUCTS COMPANY
West Lafayette, Ohio

eye-fi RE/LIGHTING



Gold Seal Tape splices neatly, fast

It has high dielectric strength without bulk — a big advantage in many splicing jobs. It's elastic . . . easy to mold into a neat, thin wrapping. Just what the doc ordered for cramped areas, but we birds see more Gold Seal used for insulating cable splices than any other tape. High service line or terminal box, quality and convenience *talk* — and that's Gold Seal Plastic Tape, in the handy 20 ft. roll. Try it! Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.

Ten 20 ft. rolls in the Handy Pack can
Single 60 ft. rolls in individual metal cans

Gold Seal Tape

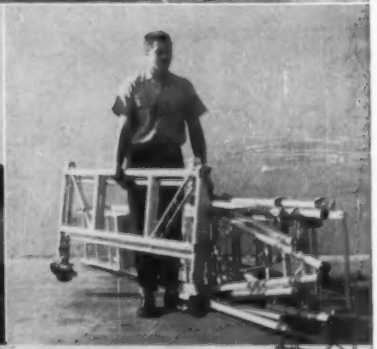
IN HANDY 20 FOOT ROLLS

Gold Seal FRICTION — RUBBER — **PLASTIC** Tapes . . . Commercial and Specification Grades

UP-RIGHT ANNOUNCES

TALLESCOPE ...telescoping aluminum work platform for overhead construction and spot maintenance

Lightweight, rapidly assembled by one man. Extends instantly for reaching heights up to 30 ft. Telescopes for rolling under trusses and other obstacles. Adjustable legs for uneven floors or stairways.



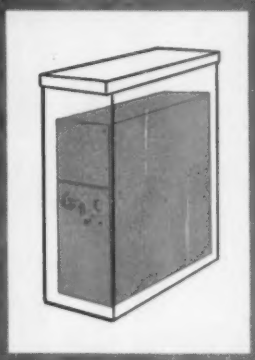
Rolls through doorways . . . only 29" wide, telescopes and folds down.

Bridges over auditorium seats.

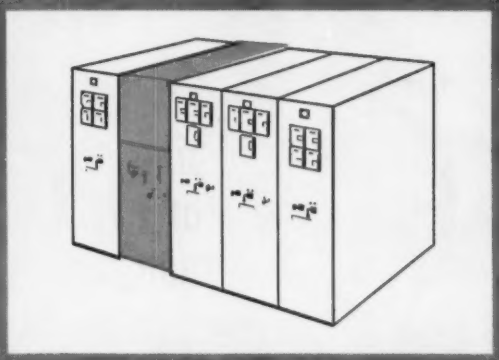
Separates easily into 3 components for convenient storage or transportation.

FOR TALLESCOPE CIRCULAR
WRITE TO
UP-RIGHT SCAFFOLDS
DEPT. 177 • 1013 PARDEE ST., BERKELEY, CALIF.

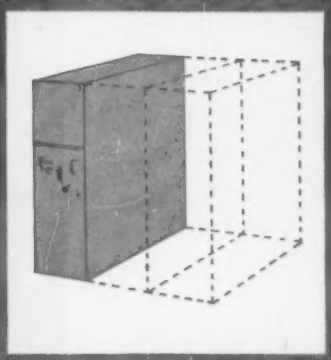
MANUFACTURED BY
UP-RIGHT
SCAFFOLDS



Indoor or outdoor units



Line-up with G-E Metal-clad



Single or multiple units

Installation versatility with

General Electric ROLLOUT

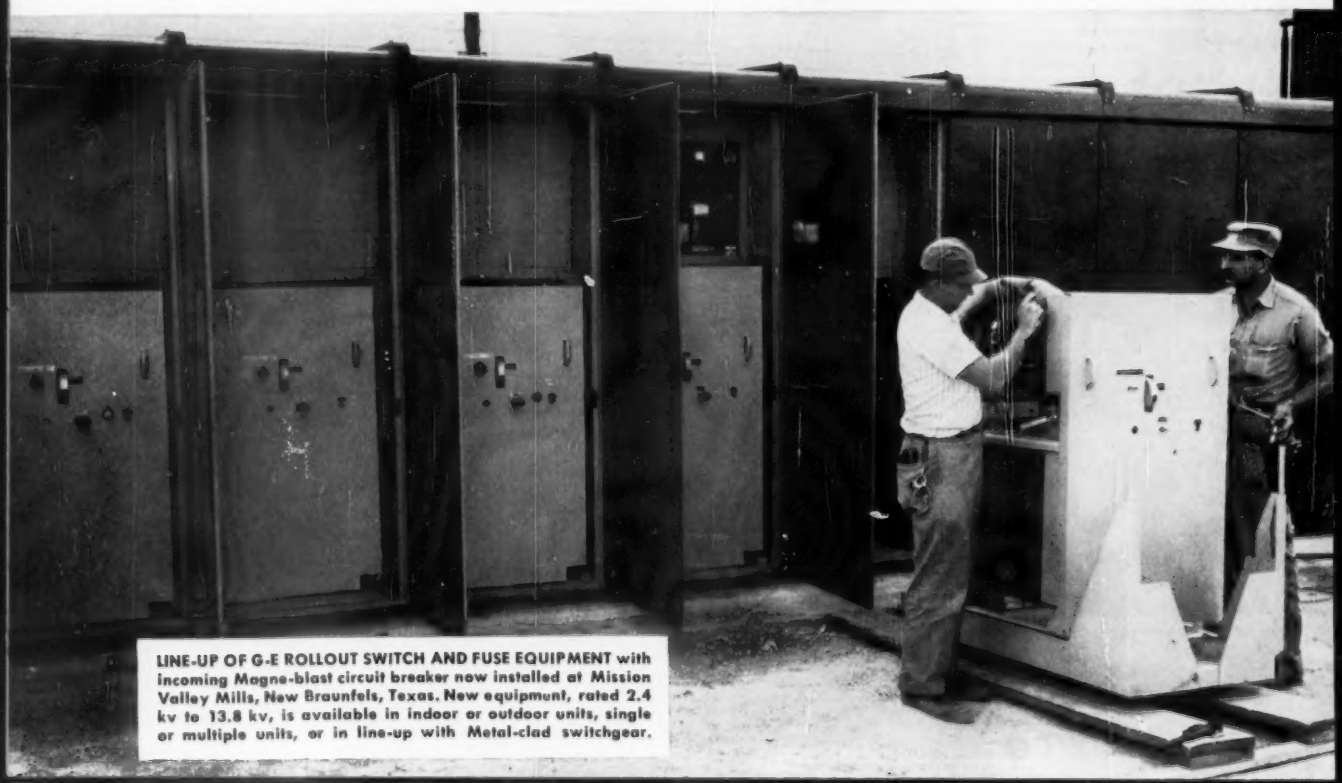
Switch and Fuse Equipment

You have a choice of construction types with General Electric's Rollout Switch and Fuse Equipment. It can be furnished to suit your installation needs—indoor or outdoor units, single or multiple units, or in line-up with General Electric Metal-clad.

Whichever type of construction you select you get improved protection, greater safety, and ease of maintenance and inspection. For more information call your nearest General Electric Apparatus Sales Office or write for Bulletin GEA-6623, General Electric Co., Section F514-5, Schenectady, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC



LINE-UP OF G-E ROLLOUT SWITCH AND FUSE EQUIPMENT with incoming Magne-blast circuit breaker now installed at Mission Valley Mills, New Braunfels, Texas. New equipment, rated 2.4 kv to 13.8 kv, is available in indoor or outdoor units, single or multiple units, or in line-up with Metal-clad switchgear.

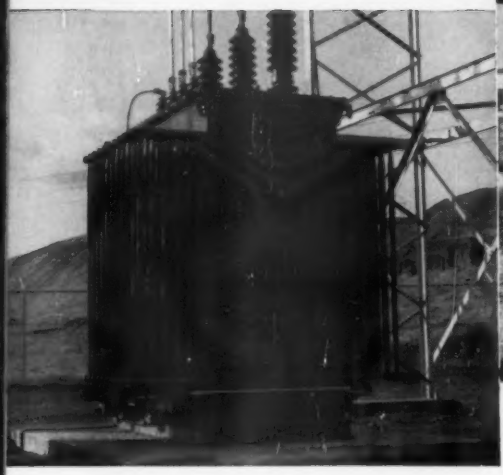
from

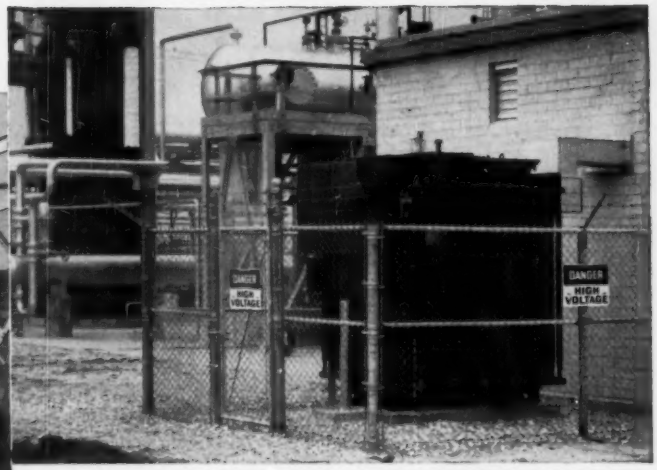
This 2500-kva Uptegraff power transformer, being installed at the Taunton Municipal Lighting plant in Massachusetts, is one of several units used in conjunction with a new 16,500-kw turbine unit.

One of several Uptegraff transformers furnishing power for the Benzene Toluene plant addition to the Richfield refinery at Wilmington, California. Long, trouble-free performance is vitally important in round-the-clock refinery operations.

kv to 13.8 kv, is available in indoor or outdoor units, single or multiple units, or in line-up with Metal-clad switchgear.

MASSACHUSETTS to CALIFORNIA





Here is a 1500-kva Uptegraff power transformer located in Cleveland, Washington. It is one of several Uptegraff transformers serving the Klickitat County public utility at Goldendale.

This 1000-kva liquid-filled load center transformer is one of several Uptegraff transformers helping supply the power requirements for a new Celanese Plastics Division plant in Houston, Texas.

Uptegraff transformers serve industry's power needs!

The *extra* quality of today's Uptegraff transformers is due to a forward-looking program in research and development. This involves new and better raw materials, fabricating systems and assembly methods. It has resulted in important transformer advances . . . lasting oil preservation . . . completely leak-proof tanks and fittings . . . use of grain-oriented steel core for lighter weights, smaller sizes, lower core loss and exciting current . . . flow-painted exteriors assure three-mill paint coat and complete coverage . . . etc.

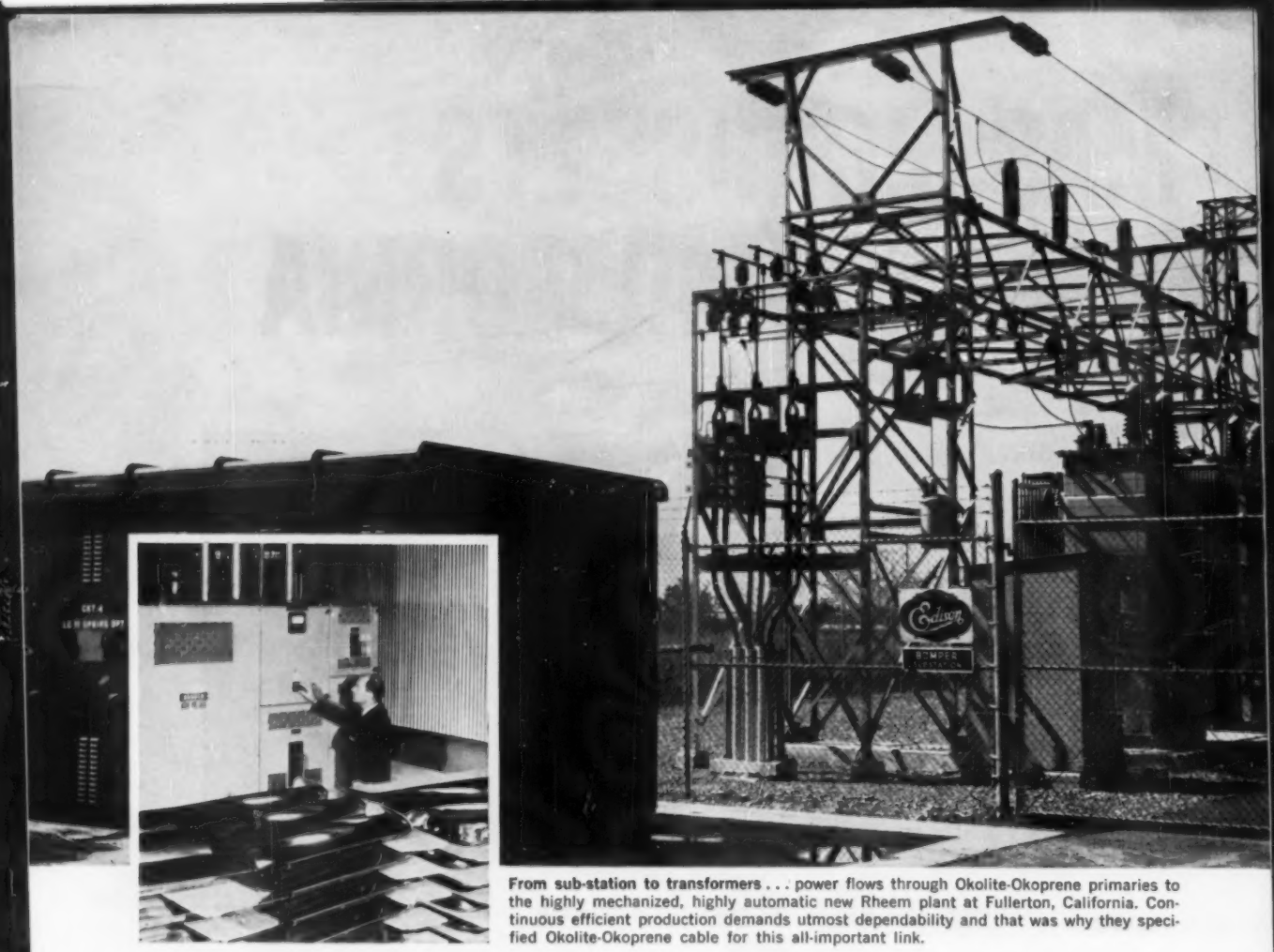
New designs provide capacity beyond normal rating

These improvements *plus* strict quality control in manufacturing and advanced testing methods assure the *extra* transformer capacity *beyond nameplate rating* to successfully withstand momentary overvoltages, high temperatures and other abusive conditions.

Meet the people of the Uptegraff Company

This picture-story booklet will give you an intimate view of the Uptegraff Company, and the people who design and build Uptegraff transformers. *Send for your copy TODAY.*

R. E. UPTEGRAFF MANUFACTURING CO.
SCOTTDALE, PENNSYLVANIA



From sub-station to transformers . . . power flows through Okolite-Okoprene primaries to the highly mechanized, highly automatic new Rheem plant at Fullerton, California. Continuous efficient production demands utmost dependability and that was why they specified Okolite-Okoprene cable for this all-important link.

Okolite-Okoprene 12kv primaries specified for Rheem's "must-not-fail" operation

"When you're dealing with 12,000-volt primary distribution, you don't fool around," says Mr. Arthur A. Pfeifer, assistant to the General Manager of Rheem Manufacturing Company's Automotive Division at Fullerton, California.

"The Fullerton plant is one of Rheem's newest and smartest and had to have nothing but the latest and best equipment. We knew that meant Okolite-Okoprene cable and we used it. It has worked perfectly since installation, has required no maintenance, and we would recommend it to anyone."

Selected as one of the ten best new plants in the country last year, this highly efficient plant uses the most modern power distribution techniques to keep its plant presses and plating baths operating. Production will pass one million auto bumpers, one million auto springs and three million bumper arms per year.

All power for this must-not-fail operation flows through Okolite-Okoprene 12,000-volt primary distribution lines, designed to supply a future 100% increase in plant capacity. They connect outdoor sub-station switchgear to 13 indoor step-down transformer centers which distribute to plant operations at 480 volts.

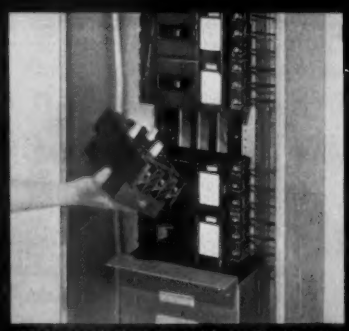
For *your* vital circuits, Okolite-Okoprene offers constructions of utmost reliability combined with exceptionally long life. Okolite insulation has a 30-year record of service, maintaining in severest installation conditions its high dielectric strength and great resistance to corona cutting, moisture and heat. Okoprene sheathing offers unusual protection against weather, abrasion, ozone, heat, cold, many acids, alkalies, and chemicals. Application of the insulation by the strip process is the ultimate assurance of matchless quality. For the Okolite-Okoprene cable that best suits your needs, see 128-page Bulletin EC-1075. It's free; just write The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

6221

Electrical maintenance made easier with 3-way STABreaker Flexibility

STABreaker for AB-I's



STABreaker for Lighting and Power Panelboards

STABreaker for Bus Duct Plug-ins

With STABreaker, one inventory is all you need to meet all your circuit breaker requirements... whether it's for AB-I's, for Power and Lighting Panelboards or as Bus Duct Plug-ins. The only "plug-in" type AB breaker that can be used interchangeably in all three applications — STABreaker saves you time and effort... provides greater freedom than ever before in changing ratings and systems (from single-phase to three-phase)... reduces inventory... simplifies installation. Immediate "over-the-counter" STABreaker availability from your local distributor. AB-I's from 15 through 400 amps in only two standard enclosures. Lighting and power panelboards up to 600 amp mains, 400 amp branches in only four enclosures. Bus Duct Plug-in ratings from 15 through 100 amps. Write for detailed Bulletins 1-155 and 1-160: Federal Pacific Electric Company, General Offices: Newark 1, New Jersey.

FPE

FEDERAL PACIFIC ELECTRIC COMPANY

The Best in Electrical Distribution and Control Equipment

This New Installation by Litecontrol

is Paying For Itself — FAST!

Handsome lighting? Yes. Functional? Certainly. Yes, and if you're an architect, engineer or contractor with a job to do and a client or customer to convince, here's strong evidence on how remodeling can pay for itself.

Litecontrol fixtures feature the very efficient Holophane #6024 low brightness acrylic lens in luminous panels 10′ x 24′. Ceiling tiles and lens are supported by the same aluminum T-bars — all supplied by us to provide an integrated ceiling and lighting system in this "Certified Lighting Job".

Result: This quality lighting is helping to make the merchandise "move" faster. The owner is naturally very pleased — the second month (August) after remodeling, more business was done than in the previous December, with the same amount of stock. Best of all, the owner estimates that this increased volume will mean paying off the remodeling investment 3 times faster than originally calculated.

Beauty . . . efficiency . . . or sound dollars and cents arithmetic in commercial lighting — Litecontrol can offer you *all*. Think of us for *your* next job.

INSTALLATION:	Wilson's Inc., Wickford, R. I.
ARCHITECT:	MacConnell & Walker, Apponaug, R. I.
ENGINEER:	Ted Baker, Narragansett Electric Co., Providence, R. I.
ELECTRICAL CONTRACTOR:	Loring Electric Co., Wickford, R. I.
DISTRIBUTOR:	Graybar Electric Co., Inc., Providence, R. I.
FIXTURES:	Litecontrol luminous lens ceiling panels, each 10′ x 24′, using Holophane #6024 acrylic lenses. F96T12 slimline deluxe cool white lamps on 24″ centers. Accent spotlites by others. Litecontrol #8344RS fixtures in Show Windows plus accent lites by others.
INTENSITIES:	Average through store, 100 footcandles in service, not including spotlites. Average in Show Windows, 250 footcandles in service.

LITECONTROL

Fixtures

KEEP UPKEEP DOWN

LITECONTROL CORPORATION,

36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

Continued from page 4

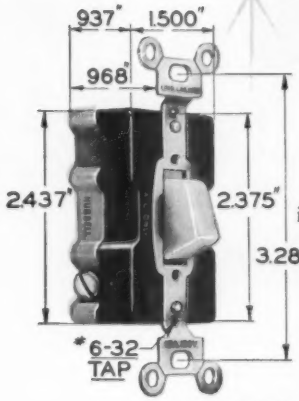
Quality... you can put your finger on...

IT PAYS TO USE HUBBELL GOOD CONNECTIONS

A. C. presSwitch TRADEMARK with lighted button

UL

No stumbling or fumbling in the dark to find this switch. A tiny, subminiature, neon bulb in the button is always "on" when the switch is "off", showing you right where it is, day or night. It's the last word in switch safety, luxury and convenience, . . . and it costs only pennies a year to operate.



This lighted button "Presswitch" is the latest in Hubbell's complete line of "Presswitch" units, now available both lighted and unlighted and in 15 and 20 ampere ratings. All "Presswitch" devices fit standard boxes and utilize standard wall plates. No special wiring is involved.

CAT. NO. 1257-I
15 amperes, 120 volts,
A.C. Single-pole,
with lighted ivorine button
and feed-thru terminal

engineering news

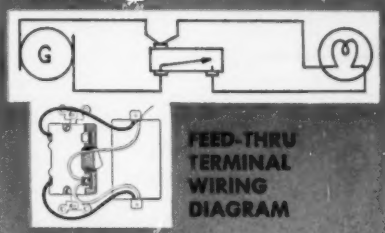
HARVEY HUBBELL, INCORPORATED
Engineering Department

WHY A FEED-THRU TERMINAL ON SINGLE POLE "PRESSWITCH" UNITS...

This is exactly what the "Press-Switch" FEED-THRU TERMINAL gives you. This terminal:

1. *Has no electrical connection inside the switch.*
2. *Serves as a convenient binding post for a thru-feed splice.*
3. *Provides a very secure connection.*
4. *Provides a very neat and compact installation.*

THUS...



FEED-THRU TERMINAL WIRING DIAGRAM

You simply loosen the binding screw, push the stripped wire ends into the holes provided, and tighten the binding screws back down.

You have only to add up the total number of single pole switches used on a single job to realize the great savings in time and effort and space to be gained by using this extra terminal—a terminal put there PRIMARILY FOR THE ELECTRICAL CONTRACTORS CONVENIENCE!

HARVEY HUBBELL, INCORPORATED
BRIDGEPORT 2, CONNECTICUT — IN CANADA: SCARBOROUGH, ONTARIO

Highest Quality
wiring devices
machine screws

Standard of the Industry

They May Look the Same Outside— but the Inside Story is Different

When you buy on performance, *not* on looks and claims, the difference between binoculars or circuit breakers is plain to see. Successful contractors—thousands of them—find that the performance of C-H Unit Breakers amounts to an extra "edge" that insures customer satisfaction and betters their business. Get that edge for yourself—feature C-H Unit Breakers! See your nearby Authorized Cutler-Hammer Distributor or write for the new selection guide, Handi-Log, Pub. MS33-**A241.** Cutler-Hammer Inc., Milwaukee 1, Wisconsin.

"Thousands of Contractors know **C-H** *Unit Breakers save costly call-backs"*

1. Used constantly by thousands of contractors who buy breakers on performance, NOT on claims. Repeat purchasing proves satisfaction.

2. Used in prominent large housing projects from coast to coast with complete satisfaction to builders, contractors and home buyers.

3. 568 respected Authorized Cutler-Hammer Distributors stock and recommend Cutler-Hammer Unit Breakers.

Sell Satisfaction with full ***HOUSEPOWER***®

CUTLER-HAMMER
CONTROL
C-H

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • *Division:* **Airborne Instruments Laboratory.** • *Subsidiary:* **Cutler-Hammer International, C. A.**
Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation, Inc.

750 MCM Single Conductor 91 Strands, 5KV Shielded SUPER-PARARITE PARAPRENE CABLE.

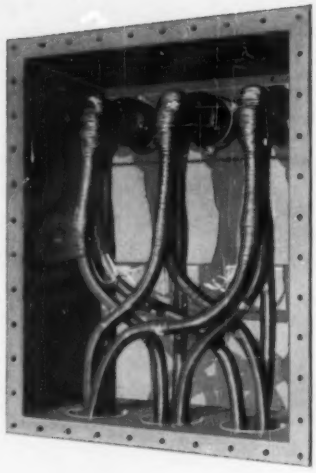
PARANITE®

SUPER-PARARITE® PARAPRENE®

CABLE

Installed at Turkey Creek

Here's another example of power—Paranite—and American industry . . . the selection of Super-Pararite Paraprene Cable for the new Turkey Creek Pumping Station at Kansas City, Missouri. The Super-Pararite butyl conductor insulation is recognized for superior resistance to heat, cold, moisture, oxidation and ozone, while the Paraprene neoprene jacket possesses inherent resistance to sunlight, abrasion, ozone, heat, oil and chemicals . . . one of many Paranite products which has earned the industry reputation—"IF IT'S PARANITE IT'S RIGHT."®



PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Fort Wayne 6, Indiana

MANUFACTURING PLANTS: Birmingham, Ala.; Anaheim, Calif.; Jonesboro, Ind.; Marion, Ind.; Tiffin, Ohio

Sales Offices in all Principal Cities

W. V. Pangborne figures costs closely

– but doesn't take chances

The Walt Whitman Bridge cost $85 million to complete. Lighting the bridge and its approaches, an installation including 750 time-controlled mercury lamps, 20 toll booths, and 21 substations, was a $2,500,000 job for W. V. Pangborne & Company, Inc., one of the oldest and largest electrical contractors in the Philadelphia area.

Electrical connectors accounted for only ⅛ of 1% of Pangborne's total contract. But the entire electrical system depends on that vital ⅛ of 1%. How much money could have been saved on this small percentage? Not enough to take chances... Pangborne didn't. They made sure by using the Burndy connectors that years of experience had taught them to depend on.

That's what hundreds of contractors have learned, on thousands of trouble-free, Burndy-connected jobs, over more than 30 years. It doesn't pay to take chances on power failures and callbacks... it does pay to connect with Burndy.

"We can depend on Burndy's representative for the answer to any electrical connection problem. We get quick service... local Burndy distributors carry a complete stock of connectors. Burndy has the connector we need... or will make it for us."

— L. W. "Barney" McQuade, W. V. Pangborne & Company, Inc., field engineer on the Walt Whitman Bridge job.

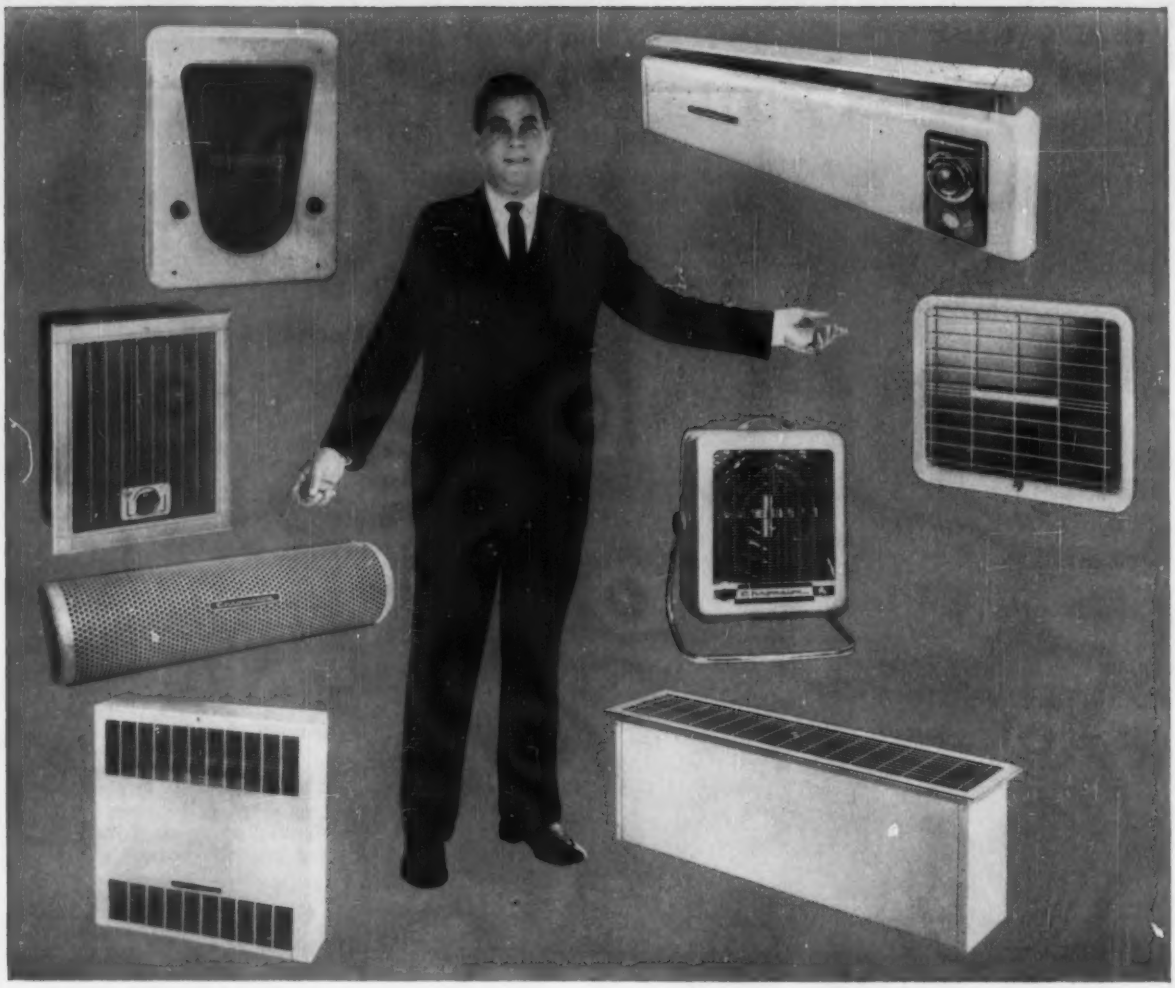
Walt Whitman Bridge, Phil., Pa.—Camden County, N. J. Constructed by Delaware River Port Authority. W. V. Pangborne & Co., Inc., electrical contractor. Photo courtesy Bethlehem Steel Co.

BURNDY

ELECTRICAL CONNECTORS

Norwalk, Conn. | In Europe: Antwerp, Belgium | Toronto, Canada

58 33



New house? Old house?

. . . for every room in any house CHROMALOX has the answer

Upstairs, downstairs, all through the house . . . or school, church, motel or office . . . there's a Chromalox Electric Heater *designed* for the heating job.

Chromalox Electric Baseboard Heaters are available in many sizes and ratings, with matching blank, corner and trim sections for a uniform appearance.

Chromalox Radiant Wall Panels, Wall Insert Heaters and Cabinet Convector Heaters provide abundant heat to meet a variety of other heating requirements and decorating tastes.

Chromalox Floor Drop-In Heaters quickly stop heat loss caused by "picture" type windows.

Chromalox Utility Spot Heaters and Portables concentrate heat where and when it's needed for laundries, workshops, garages and other small, occasional-use areas.

In addition to all these, the Chromalox line includes unit ventilators, fan driven heaters, Thermwire heating cable, in-duct heaters, and others. Chromalox offers you: good profits, customer satisfaction, nation-wide distribution, and local Chromalox engineering assistance. Write now, or call your Chromalox "Man with the Answers."

4979

LIVE BETTER . . . HEAT ELECTRICALLY

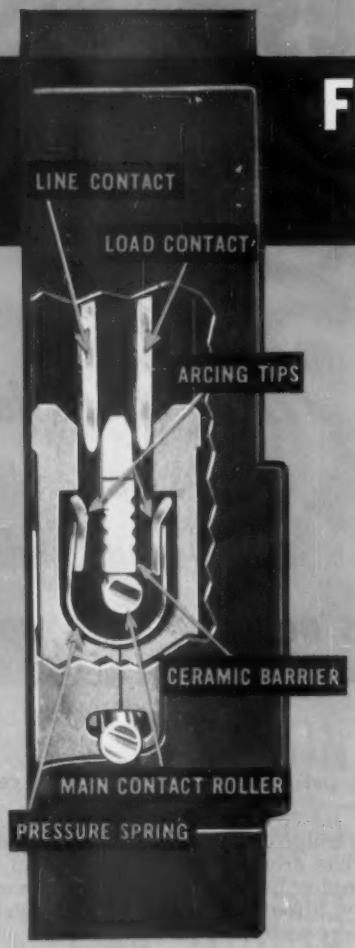
CHROMALOX
Electric Heat
INDUSTRIAL • COMMERCIAL • RESIDENTIAL
EDWIN L. WIEGAND COMPANY
7637 Thomas Boulevard • Pittsburgh 8, Pa.

The only safety switches that give you all these exclusive features!

FRANK ADAM SHUTLBRAK

TYPE SAHD—HEAVY DUTY

SAFETY SWITCHES



- **FLUSH MOUNTING** or surface mounting. Frank Adam's is the only front-operated heavy duty switch that makes recessing possible.
- **FRONT HANDLE OPERATION** permits close side-by-side installation without the great waste of space normally required for side-operated switches.
- **SHUTLBRAK® SWITCH MECHANISM** positively prevents arcing and pitting of main contacts.
- **KAMKLAMP FUSE HOLDERS** lock fuse terminals immovably in place without dependence on insecure spring tension.

These exclusives, *plus* all the other advanced features of FA SHUTLBRAK safety switches, save installation time and guarantee a more dependable, failure-free job. Try them—convince yourself—on your next project.

Write for catalog pages.

FA Products are the sign of a better job

FRANK ADAM ELECTRIC CO.

P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MISSOURI

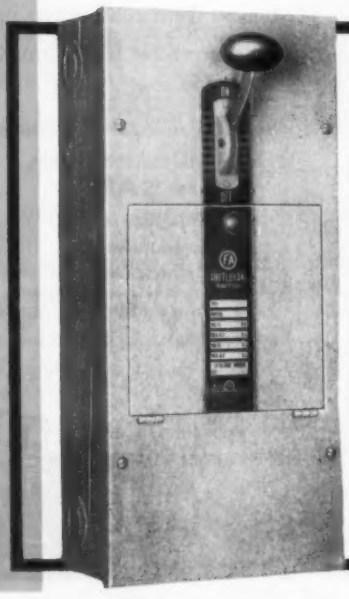
busduct • panelboards • switchboards • service equipment
safety switches • load centers • Quikheter

SEE OUR CATALOG IN SWEET'S

Quick-make, Quick-break SHUTLBRAK SWITCHES ...can't arc or pit

- When closing, ceramic barrier precedes main contact roller between line and load blades; follows roller out as switch opens, thus preventing burning or pitting at this vital point.
- In initial "Make" or final "Break," outside edges of silver-plated line and load blades contact compression-held arcing tips and divert any momentary arc.
- When "On", main contact roller is held under pressure between line and load blades. Extensive tests have proved full-floating silver-plated main roller contact is always kept polished by in-and-out movement of shuttle.

FRANK ADAM



TYPE SAHD—HEAVY DUTY

- Increased horsepower-rating. Exceeds NEMA standards. Listed by Underwriters' Laboratories for label service.
- Capacities: 30 to 1200 amps., 250-v. AC or DC; or 600-v. AC or DC in 2, 3 or 4-pole single throw.
- Door is locked when handle is "On"; can be opened when handle is "Off." Switch cannot be thrown "On" when door is open. Unmarked intermediate position permits access by instructed persons. Lever padlocks "On" or "Off."
- Entire switch unit removable to simplify cable pull-in. Solderless pressure connectors.
- Plenty of wiring space, top, bottom, sides and back. Knockouts, rear, sides, top, bottom.

Jet Line Gun Saves Hours!

New fast safe system for wiring conduit eliminates need for fish tape!

DON'T

use a steel fish tape and spend many dangerous hours snaking it through a conduit.

Don't snake it . . . jet propel it! That's the Jet Line system in a nutshell.

A small, jet-propelled cartridge does the trick! Launched by the Jet Line Gun, it twists around ells and bends up and down as it lays a strong nylon line in the conduit in seconds. Using the nylon line, draw a foot-marked Jet Line polyethylene rope through and you're ready to pull wire.

Safe, sure and fast, the Jet Line system saves wire, money and time!

Thousands of contractors use the Jet Line Gun.

Order your Jet Line Gun Kit TODAY!

DO

use a Jet Line Gun and safely jet-propel a nylon line through the conduit in seconds!

The Jet Line System is SAFE!

- No powder charge
- No explosion
- Both nylon line and polyethylene rope are non-conductors.

The Jet Line Gun

was invented by experienced electricians for use in rigid and flexible steel conduits, underfloor and underground ducts and cavity wiring structures. For runs up to 300 ft. . . . double this distance when launched into both ends of the run.

Ask your distributor or write

Pat. Pending on Method and Apparatus

Jet Line Gun Company

730 Seigle Ave., Charlotte, N. C.

3510

Copyright 1958 Jet Line Gun Co.

Some of the P&S Devices featured in the new school

INSURE CONTINUOUS SERVICE, LOW MAINTENANCE with P&S WIRING DEVICES...

Pass & Seymour wiring devices are installed throughout the new St. Louis Park Senior High School. Here's another example of the trend to P&S – where dependability and low maintenance costs are factors. Thousands of modern planners look to the proven performance of P&S products for institutions, hotels, stores, plants and offices. Wherever continuous electrical service is essential, you'll find Pass & Seymour devices. Make sure your plans include Pass & Seymour quality-made wiring devices.

15AC1
HEAVY DUTY
SWITCH
15 AMPS.
120/277 V.,
A.C.

20AC1
HEAVY DUTY
SWITCH
20 AMPS.
120/277 V.,
A.C.

5252
3-WIRE
GROUNDING
OUTLET
15 AMPS.
125 V.

Send for catalog on Pass & Seymour's complete line of modern wiring devices, Dept. ECM-159.

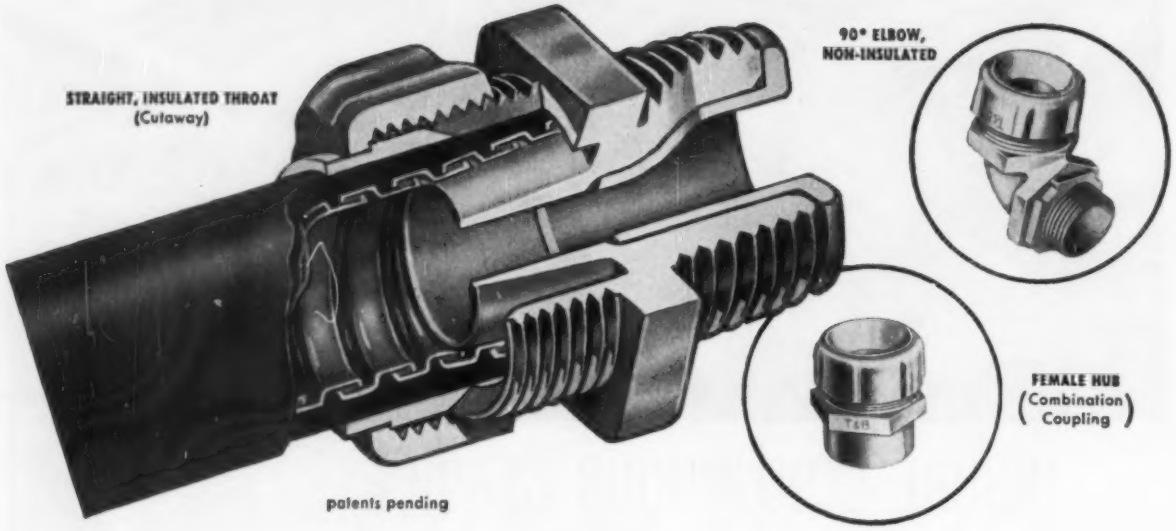
PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK
60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill.
In Canada; Renfrew Electric Limited, Renfrew, Ontario

MAKE THE COMPLETE JOB *COMPLETELY* P&S

ONLY T&B CONNECTORS

*for flexible liquid-tight conduit**

OFFER ALL THESE ADVANTAGES



THE T&B LINE provides a size range of ⅜" to 4" in the straight, 45° and 90° angle types . . . both insulated and non-insulated.

THE T&B LINE includes combination couplings from ⅜" to 1¼".

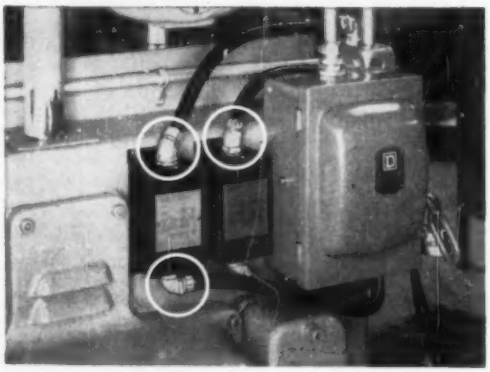
A T&B Liquid-Tight connection can't be half safe. The mechanical strength, continuity of ground, and oil seal are all interdependent. Each gives positive assurance that you have all three. And T&B's more compact design means easier installation and improved appearance.

Your T&B distributor has this complete line in stock. Be sure to ask for a demonstration . . . or write direct to T&B for detailed specifications.

* *Sealtite or equivalent*

THE T&B INSULATED LINE complies with all codes:

The National Electric Code (Paragraph 3736b)
J.I.C. Standards (Paragraphs 22.1.7 and 22.2.2)
Machine Tool Electrical Standards (Paragraph 22.1.7)



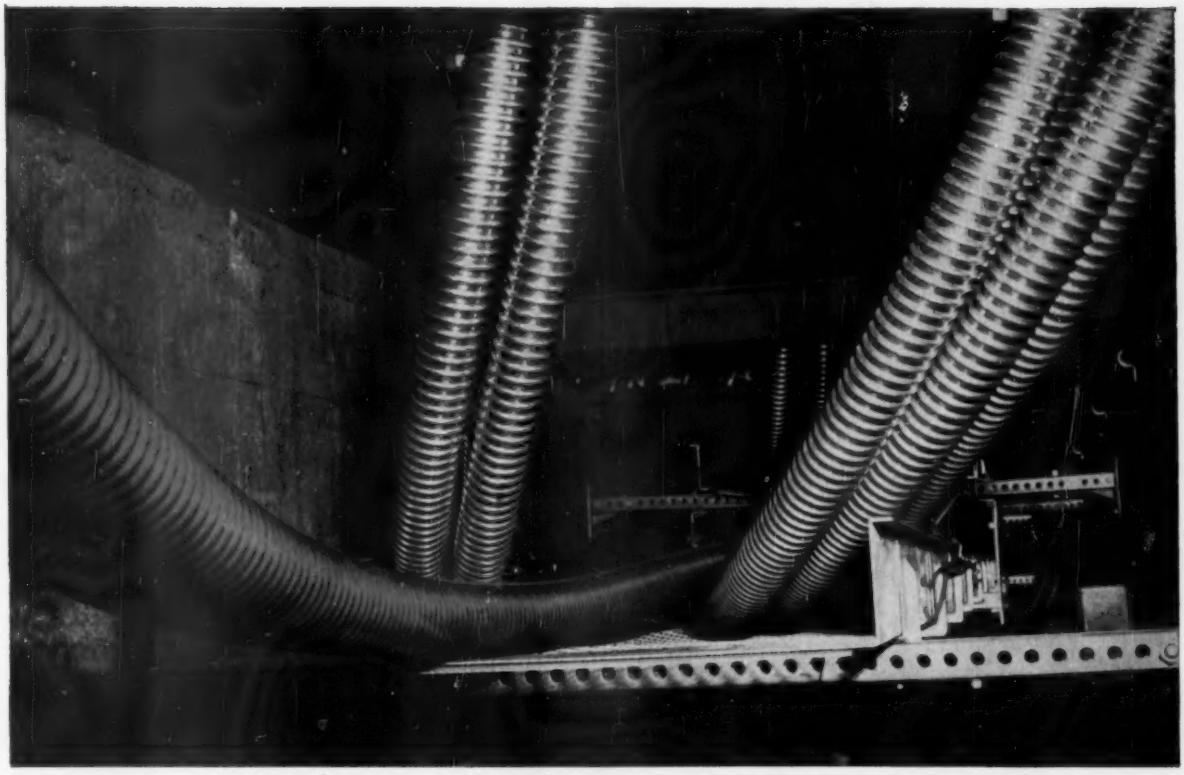
LOOK FOR THIS SIGN — AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED **T&B** DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

THE THOMAS & BETTS CO.

INCORPORATED
34 BUTLER STREET, ELIZABETH 1, NEW JERSEY
THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 189*



Quick identification for high voltage primaries is provided by an Okonite-developed, baked-on enamel finish in bright orange. In this access tunnel below transformer enclosure 3/c 15kv Okonex primaries are laid in same tray with 3/c 600v Okonex secondaries with plain aluminum Loxarmor. Plant and electrical system were engineered and designed by Southwestern Engineering Company. Electrical contractors were Trowbridge & Flynn Electric Company.

"Power supply is vital," said Diamond Gardner Corp.
"We furnished Okonite cables," said Del E. Webb and SWECO

Here was an ultra-modern, completely integrated manufacturing operation where power failures could trigger a costly "chain reaction" in down time. That's one reason why Del E. Webb Construction Company and Southwestern Engineering Company furnished Okonite cables for extensive use in the new and unique mechanical pulping mill for Diamond Gardner Corporation's Integrated Forest Products Center at Red Bluff, California.

Another reason was SWECO's knowledge that The Okonite Company, because it alone makes cables by all methods, is uniquely qualified to help select the best cable for a specific circuit . . . and manufacture it to suit any installation conditions.

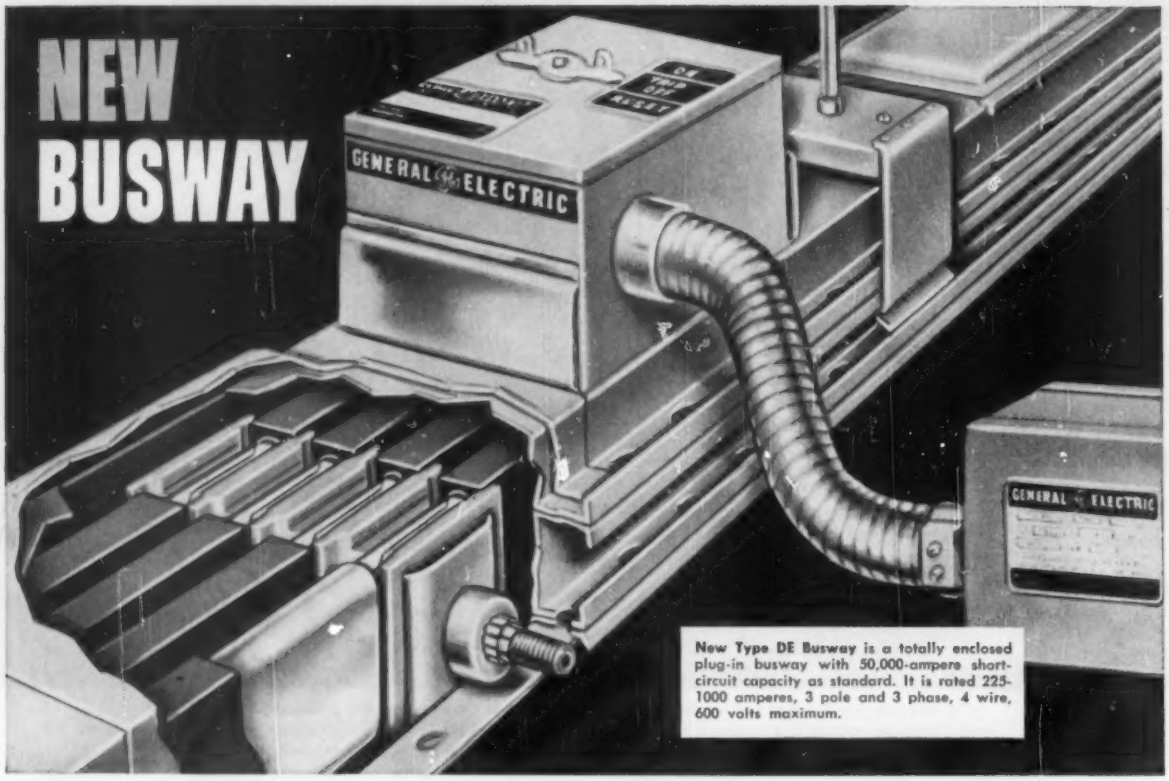
All primary and secondary power and control circuits in the plant are Okonite cables. For example: lightweight Okonex-insulated Loxarmor primaries, identified by an Okonite-developed bright orange, baked-on enamel finish, carry all power at 12kv to the twin transformer vaults in the plant. 600-volt Watertite-Loxarmor, 600-volt Okonex-Loxarmor and 5kv Okonex-Loxarmor, in racks, were selected for secondary distribution for their flexibility, low installation costs and the ease with which circuits can be added or re-routed. 600-volt Okotherm control cables were specified for circuits where high heat conditions are encountered.

Okonite quality . . . Okonite's ability to build cables by any method . . . and Okonite's expert design and installation assistance are factors to consider when ordering or specifying cables for your important installations. For more data on Loxarmor, write for free, 36-page Bulletin EC-1090, The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

6214

New idea offers more for the money . . .



New Type DE Busway is a totally enclosed plug-in busway with 50,000-ampere short-circuit capacity as standard. It is rated 225-1000 amperes, 3 pole and 3 phase, 4 wire, 600 volts maximum.

Ampere for ampere, the smallest, lightest, most efficient and rugged ever designed

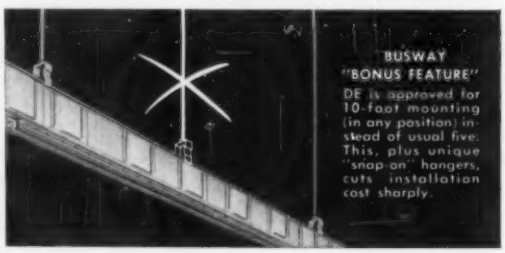
With Type DE busway you get the very best for less. Although its cost, considering material alone, is slightly higher than conventional plug-in busway, DE will generally take one-third less time to install, bringing an overall first-cost saving of approximately 10%.

At the same time, DE busway will offer benefits no other system can provide, such as:

- **New Margins of Safety.** Butyl insulation is extruded over the full length of each bus bar, virtually eliminating traveling arcs and making each plug opening essentially "dead front."
- **Greater Flexibility.** A telescoping length eliminates need for exacting layouts. This, plus the feature that allows individual sections to be removed without disturbing adjacent sections, saves time, trouble and expense in new installations, system adjustments or change-overs.
- **Greater Efficiency.** DE offers lowest voltage drop available for plug-in busway of comparable rating. Requires virtually no maintenance. Unique one-bolt electrical joint maintains contact between adjacent silver-plated aluminum bus bars with a ton of force, minimizing resistance and adding to efficient operation.

In short, Type DE busway incorporates *all* 22 of the features engineers, contractors and users say are important in busway design.

See your G-E sales representative or distributor for full details. Ask for a copy of Bulletin GEA-6173. Or write to **General Electric Company, Distribution Assemblies Dept., Plainville, Conn.**


BUSWAY
"BONUS FEATURE"
DE is approved for 10-foot mounting (in any position) instead of usual five. This, plus unique "snap-on" hangers, cuts installation cost sharply.

GENERAL ELECTRIC

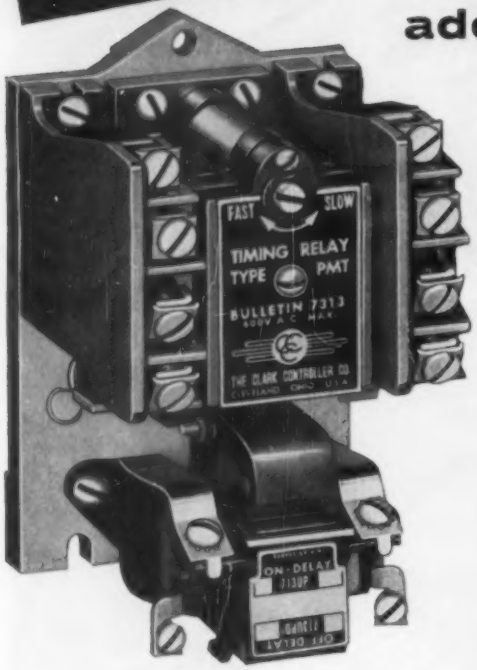
KOOL KOIL
ADVANCE
ADVANCE TRANSFORMER CO.
800 ma RAPID START
430 ma RAPID START
430 ma SLIMLINE
FLUORESCENT
LAMP
BALLASTS
Advance KOOL KOIL Fluorescent Lamp Ballasts are the result of 3 years of research, development and testing. They incorporate new grades of steel, wire, insulation and compounds. They operate cooler, give more light output and increase ordinary ballast life 3½ to 4 times.
"The Heart of the Lighting Industry"
ADVANCE
TRANSFORMER CO.

NEW!

SPACE-SAVING

TWO CLARK RELAYS

added to the "PM" Line!...



With the addition of *Time-Delay* and *Universal Pole* Relays to its "PM" line, Clark now offers *the most complete integrated line of control relays available today!* They have the same "modular" design and match physically the Convertible Pole (Type "PM") and Latch Relay (Type "PMA").

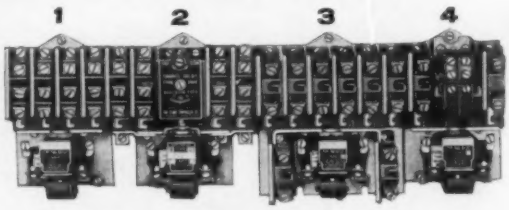
CLARK Type "PMT" TIME DELAY RELAYS

- Line up with other relays in the "PM" line.
- Timing head occupies space of 2 poles above magnet.
- Poles are "universal" type—each with 2 isolated contacts, one normally open, one normally closed, same as used on "PMA" relays described below.
- Available for "ON-DELAY" or "OFF-DELAY" operation (time delay after energization or de-energization). Easily convertible in the field.
- Timed and instantaneous poles are identical.
- Models available with either 2 or 4 timed contacts and up to 6 instantaneous contacts.

CLARK Type "PMA" UNIVERSAL POLE RELAYS

- Line up with other relays in the "PM" line.
- Each pole contains 2 isolated contacts—one normally open, one normally closed, with 600v clearance between contacts.
- Individual poles can be removed or replaced without disturbing others. Each pole has its own arcing chamber—any short circuit is confined to one pole.
- Poles are interchangeable with convertible poles of "PM" relays.
- Models available with up to 14 contacts per relay.

How Clark Relays line up to save panel space.
1. Universal Pole Relay
2. Time Delay Relay
3. Convertible Pole Relay
4. Latch Relay



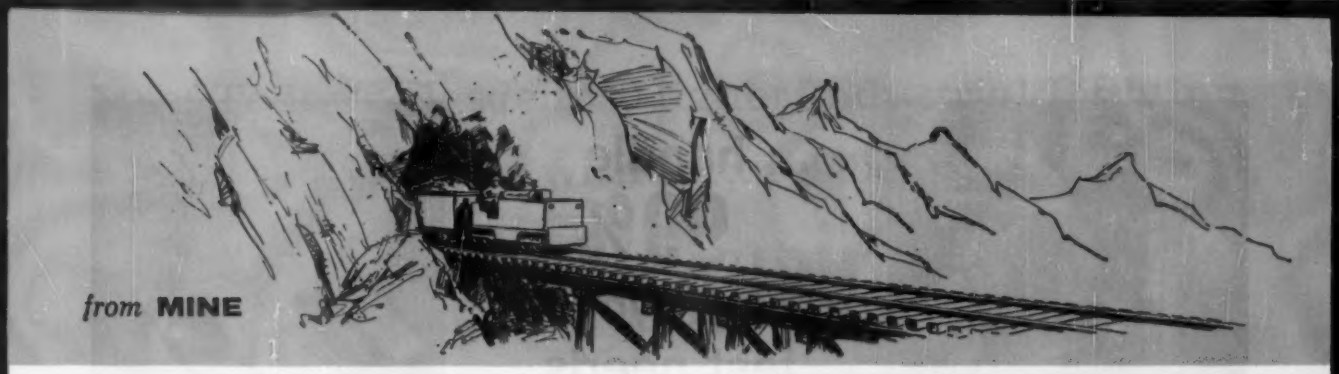
Write for complete information

The **CLARK CONTROLLER** *Company*

Everything Under Control

1146 East 152nd Street • • Cleveland 10, Ohio

IN CANADA: CANADIAN CONTROLLERS, LIMITED • MAIN OFFICES AND PLANT, TORONTO



ONE SURE SOURCE OF SUPPLY

for all your wire and cable needs

Working through a Circle distributor is good business for wire and cable users. Reasons: quality products, reliability of supply, all-out service.

Take *quality*, for example! It's a built-in plus in every Circle product—from the basic metals mined and refined by Circle's own parent company, Cerro de Pasco, right down to the finished wire and cable—all the result of a business philosophy of producing products which far surpass minimum requirements.

The same goes for supply and service. Circle users know that nearby completely stocked warehouses can usually take care of their needs. And when they can't, they know a simple telephone call by their distributor to the plant will get the fast action they want.

So why don't *you* make a Circle distributor your "one sure source of supply"—many other satisfied customers do.

C W C **CIRCLE** **WIRE & CABLE**
a subsidiary of
CERRO DE PASCO CORPORATION

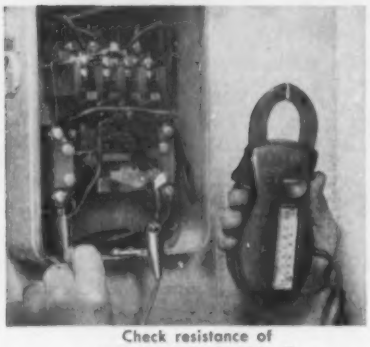
PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities

RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

Check unmarked terminals.

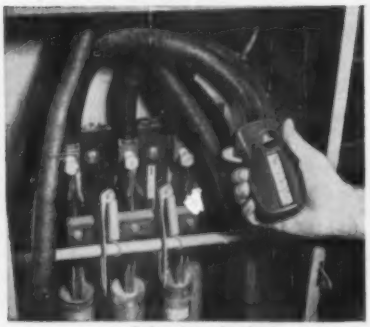
Check resistance of transformer windings of ballast.

handle 99% of all your test needs with the ALL-PURPOSE AMPROBE RS-3

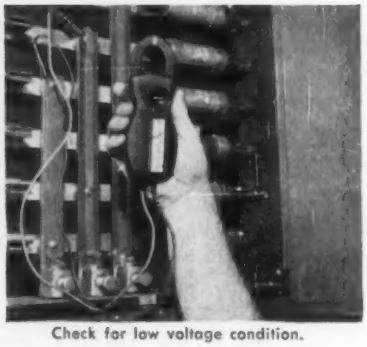


Check resistance of motor control solenoid coil.

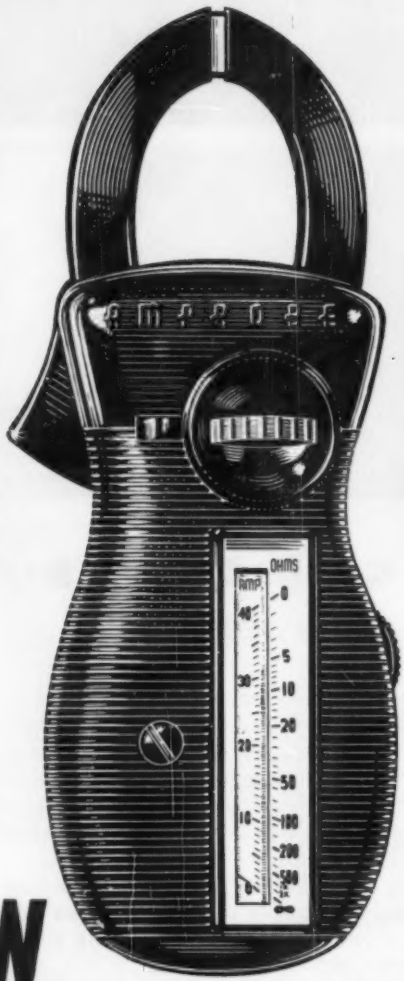
Use as continuity tester to determine if fuse is good.



Balancing circuits.



Check for low voltage condition.



There's only one way you can do it . . . with the new AMPROBE RS-3 . . . the only tester small enough to fit in your pocket, yet versatile enough to measure volts, amps, and OHMS!

NEW AMPROBE RS-3

Meets every commercial voltage requirement on three voltage scales . . . 0-150/300/600 volts ac. Accurate current readings from 0 to 300 amps on five current ranges. The ohmmeter scale is designed specifically for you . . . readings as low as 0.5 ohms can be taken, enabling you to readily distinguish the difference between short circuits and actual coil resistances.

Doesn't it make a helluva lot more sense to use this one all-purpose instrument than to tote *three* separate testers that can't even come close to AMPROBE efficiency?

Pyramid Instrument Corporation, Lynbrook, N. Y. In Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto

Meet Today's Needs for Higher Industrial Lighting Levels with fixtures bearing the RLM Quality Label

New, Higher I.E.S. Industrial Lighting Recommendations make the RLM LABEL MORE IMPORTANT THAN EVER BEFORE!

Q *Why do the new, higher, lighting levels now recommended by the Illuminating Engineering Society make the* **RLM LABEL** *More Important than ever?*

A *You can't have Quality Lighting without* **QUALITY LIGHTING FIXTURES.**

Higher Lighting levels put more importance on conformance to highest RLM concepts of lighting fixture design, construction, performance and maintenance features.

Q *What is meant by . . . "Only the RLM Label provides this essential warranty of* **UNIFORM QUALITY . . ."?**

A *It takes over* **1000 WORDS** *to cover the RLM specifications* for each type of fixture. Further, it requires the services of the Electrical Testing Laboratories of New York (an independent engineering organization) to insure uniform and consistent conformance by making periodic tests from samples secured both from the production lines and the field stocks of every participating manufacturer. The simple passing of the tests by the submission of a sample or samples is not enough. To be entitled to the RLM Label, fixtures are subject to continuous examination and must uniformly meet the RLM quality Spec's so as to insure unvarying quality from fixture to fixture.

RLM STANDARDS INSTITUTE

R-685

RLM STANDARDS INSTITUTE, INC,
Suite 8191,326 W. Madison St.
Chicago 6, Illinois

THIS COUPON IS FOR MEN WHO WANT *ALL THE FACTS*

☐ Please send the FREE RLM Specifications Book containing latest Specifications and 10 pages of facts about the RLM Label. Also, a complimentary copy of the New Higher I. E. S. Industrial Lighting Recommendations.

Name..... Title.....

Company.....

Address.....

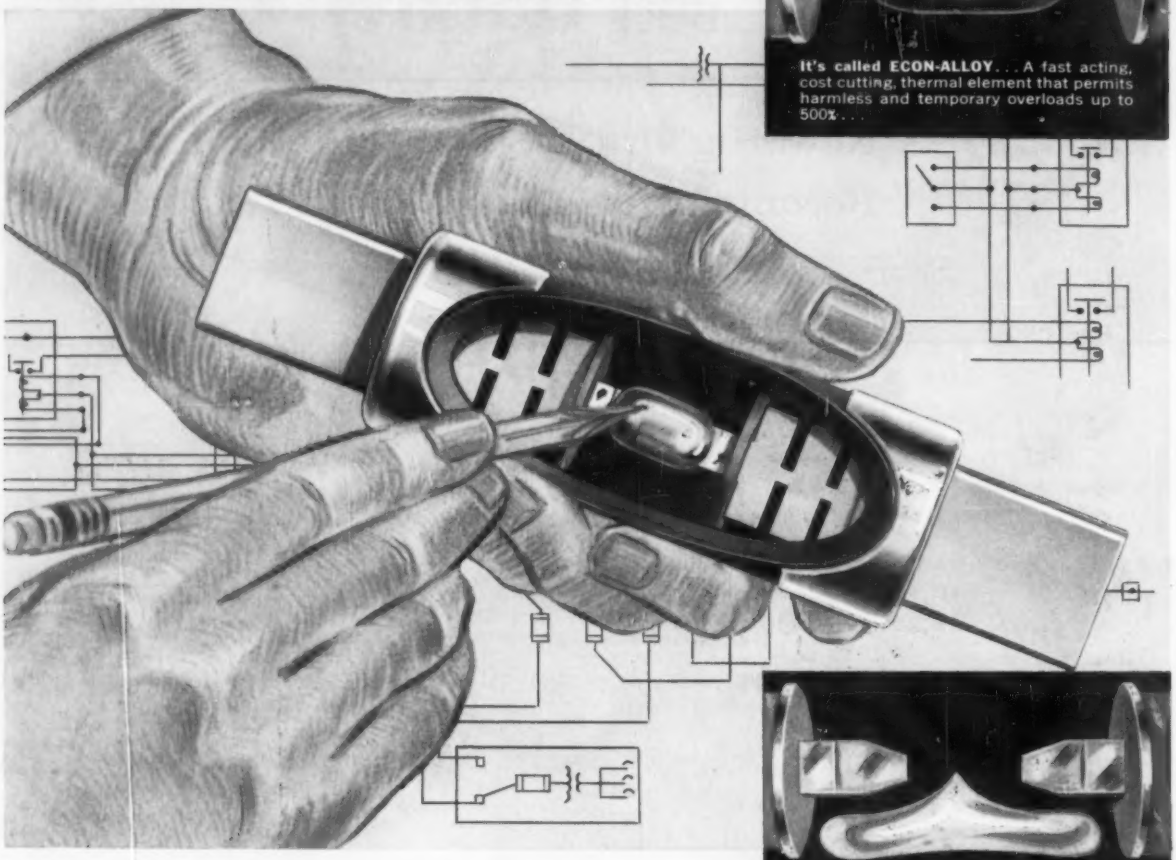
City..... Zone..... State.....

this is the exclusive ECON®

Super Safety Zone!

heart of the ECON® DUAL ELEMENT FUSE!

It's called ECON-ALLOY... A fast acting, cost cutting, thermal element that permits harmless and temporary overloads up to 500%...



ECON-ALLOY GIVES COMPLETE PROTECTION when overload exceeds predetermined time and capacity limit by changing directly from solid to liquid **completely** breaking the circuit!

515

Why risk costly work stoppages due to temporary or harmless overloads when you can have the *complete protection* of ECON® Dual Element Cartridge Fuses . . . *Econ-Alloy Thermal element* (The heart of the Super Safety Zone) permits overloads up to a predetermined time and capacity limit then *gives complete protection! Fusible Links* joined to the Econ-Alloy thermal element give instant *protection on short circuits!* Next time you buy, *specify* ECON® Dual Element Cartridge Fuses—for *complete protection!*

Available in Knife Blade or Ferrule type from 0 to 600 amperes, 250 and 600 volts. Underwriters' Laboratories listed.

Write for ECON® Dual Element Catalog S-60.

it's always extra economy to call for

ECONOMY FUSES

ECONOMY FUSE AND MFG. CO.
2717 Greenview Avenue, Chicago 14, Illinois

ASK YOUR ELECTRICAL WHOLESALER FOR ECONOMY FUSES . . . THE COMPLETE FUSE LINE

No. 11 in a series

Right off the Wire

Before the first nuclear-powered merchant vessel is launched, a new reactor system which has been designed is expected to reduce the cost of a comparable installation by forty per cent.

After leaving a new electric shaver plugged into an outlet overnight it can be used for a week without recharging.

A radio operator's vest, with pockets for dry cells, can be worn under outer garments in arctic cold. The batteries, when kept warm by body heat, are said to last ten times longer.

Automobile batteries are now made with cells which can be removed and replaced in a few minutes.

A new electronic surveying technique, now in use in highway layout work, enables engineers to establish numerous ground control points and measure distances in a matter of minutes. Maximum possible error is only 11 inches in 40 miles.

Copper strip is being made from powdered metal. The process can also be used for other metals which can be combined in no other way.

A portable building for use in the arctic has hollow walls of nylon fabric. When the walls are inflated the building stands erect.

A research program has begun for the study of new semiconductors for use in transistors. The materials are indium phosphate, gallium arsenide, aluminum antimonide.

An insulated guard rail for the end of the boom is made to protect a crane operator in case of contact with a power line.

More and better rayon is the object of a study of cellulose growth in living trees. Two-year-old pines are injected with radioactive carbon and are later cut down for examination.

A new plastic adhesive used in aircraft construction is semi-elastic and stronger than the metals it joins.

A new titanium alloy is made into sheets that will withstand air pressures of over 100 tons per square inch.

The "world's loudest noise" can be produced by a new compressed air loud speaker that is capable of projecting the human voice for ten miles.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

Twelve pneumatic tires, each supporting a load of 20,000 pounds, enable a new lift to pick up and move concrete pipe sections at five miles per hour.

The Post Office Department has awarded a contract for the development of a mechanical letter-sorting machine.

Aerodynamic shapes designed to travel at over 8,000 miles per hour can be tested in a new wind tunnel.

Layers of steel, bronze and a mixture of lead and plastic compose a new dry bearing material that requires no lubrication.

Coils of aluminum, plastic or steel, up to 82″ O.D., can now be spiral wrapped by machine.

A new method of producing electricity uses a fuel cell that converts hydrogen and oxygen into direct current by means of a catalyst.

A new recording instrument measures heat absorption in any area and is used for allocating air conditioning or heating charges to tenants.

Quartz tubing is being made so small that fifty feet contain only one drop of water.

A new heat resistant paper is made of ceramic fibers.

Simplex Goes To Sea

The 36,000-foot "sea section" of the Simplex submarine communication cable, for use between Cape Neddick, Maine, and Boone Island Light, was loaded in August at Boston.

The cable came off a giant reel (dia. of head 126 inches) and was carried over a capstan to the 126-foot barge.

The cable is described as "4-conductor, No. 9 AWG stranded, ANHYDREX insulated, armored submarine communication cable."

The reel and its load of more than six miles of cable weighed 68 tons.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and Newington, New Hampshire

Simplex

Highest quality cables for: Mining • Power & Lighting • Construction • Transportation • Communications • Signalling

"97% of our General Electric Power Groove Lamps are still going strong after 6500 hours!"

SAYS ERICKSON TOOL COMPANY, SOLON, OHIO

ERICKSON TOOL COMPANY
34350 SOLON ROAD
SOLON, OHIO

December 22, 1958

Mr. Q. D. Dobras
Application Engineering
General Electric Lamp Division
Nela Park, Cleveland 12, Ohio

Dear Mr. Dobras:

Thanks for your continued interest in our Power Groove lighting system. You have more and more reason to be proud of it.

You told us these lamps had a useful life expectancy of 5,000 hours. Now, after 15 months, or a full 6,500 hours of use, only 3% have burned out! In my opinion this is an excellent record of performance.

As you can tell, we're still mighty pleased we selected Power Grooves for our lighting. They've helped us maintain our high-quality production standards (the men think they're great), and they're practically maintenance-free.

Sincerely,

S. S. Benjamin, Vice President
Erickson Tool Company

SSB/dmw

G-E POWER GROOVES give nearly twice as much light as high output fluorescents—2½ times as much as slimlines. You can offer your customers more light per fixture, with fewer parts to maintain, and savings of 5% to 20% on original investment.

FREE! NEW 24-PAGE BOOK entitled "21 Industrial Lighting Problems Solved With Power Grooves". Illustrated book gives you the whole story on G-E Power Groove Lamp design—plus specific details on how to give customers the highest, most economical lighting levels. For your copy, write: General Electric Co., Large Lamp Dept. C-901, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

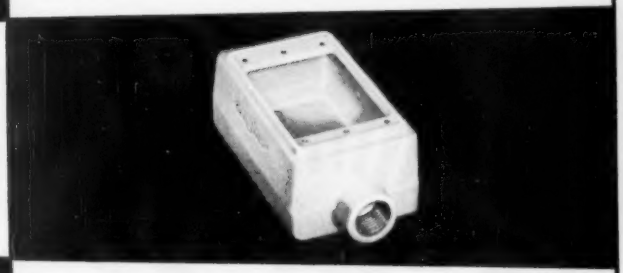
Cut costs... without cutting corners! Specify... GEDNEY CONDUIT BODIES

Gedney Conduit Bodies mean lowest installed cost! That's because they are skillfully made of tough, *malleable* iron, then hot-dip galvanized, and finally, they must pass the toughest inspection. Accurate machining and threading assure easiest installation . . . ruggedness assures longest service life!

THE GEDNEY CONDUIT BODY LINE INCLUDES ALL TYPES—SIZES ½" TO 4"

TYPE LB—Threaded—for heavy-wall rigid conduit. Use them with Gedney entrance fittings, straps, clamp backs to get an *entire* conduit system that is hot-dip galvanized.

TYPE FS—Threaded—shallow bodies for heavy-wall rigid conduit. Hot-dip galvanized finish prevents corrosive deposits—means easier installation, longer life.



SCORES OF OTHER GEDNEY FITTINGS are available for every purpose—all carefully designed, manufactured and inspected to assure economical installation and maximum customer satisfaction.

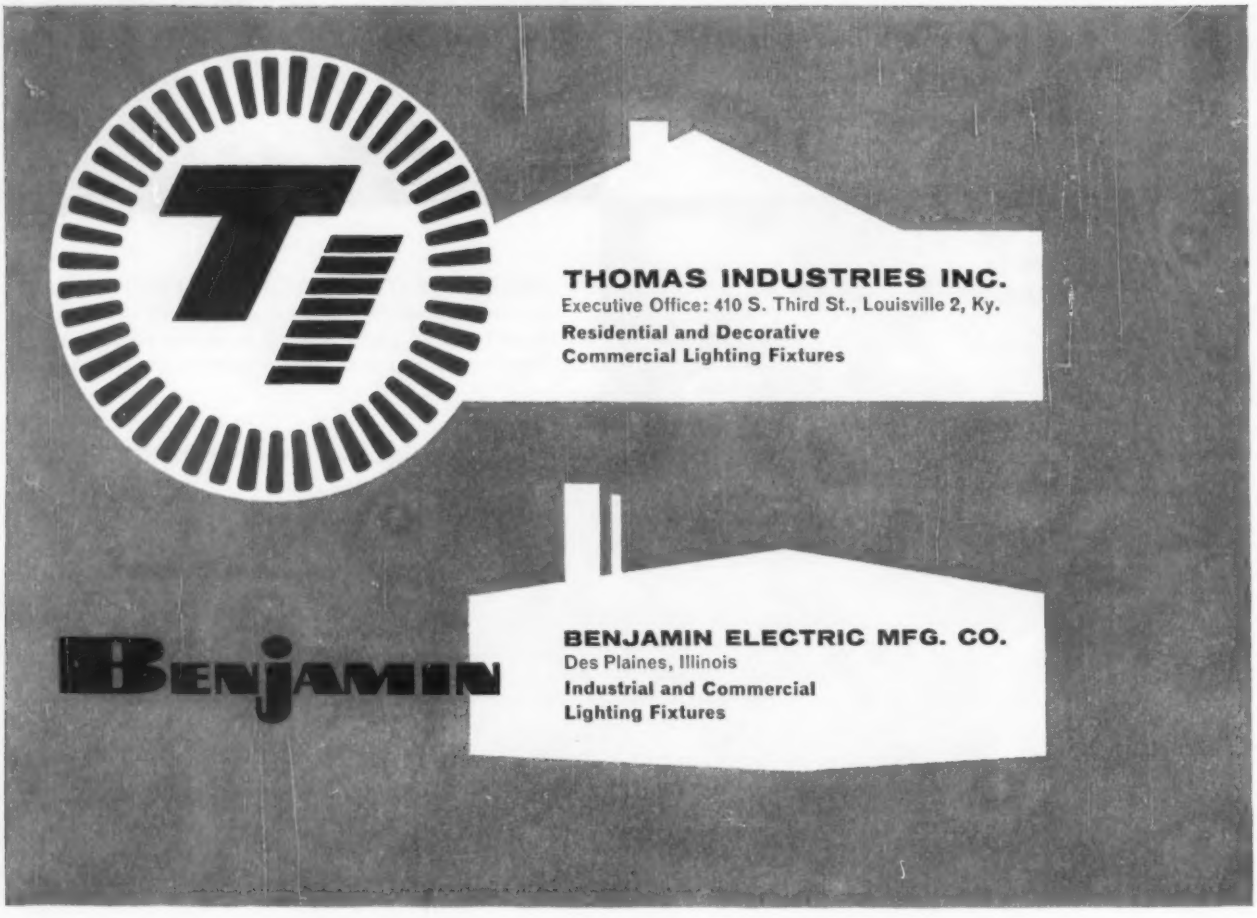
GEDNEY
ELECTRIC COMPANY

GEDNEY

RKO BLDG., RADIO CITY, NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

GEDNEY FITTINGS FIT

BENJAMIN JOINS THOMAS



INDUSTRIES

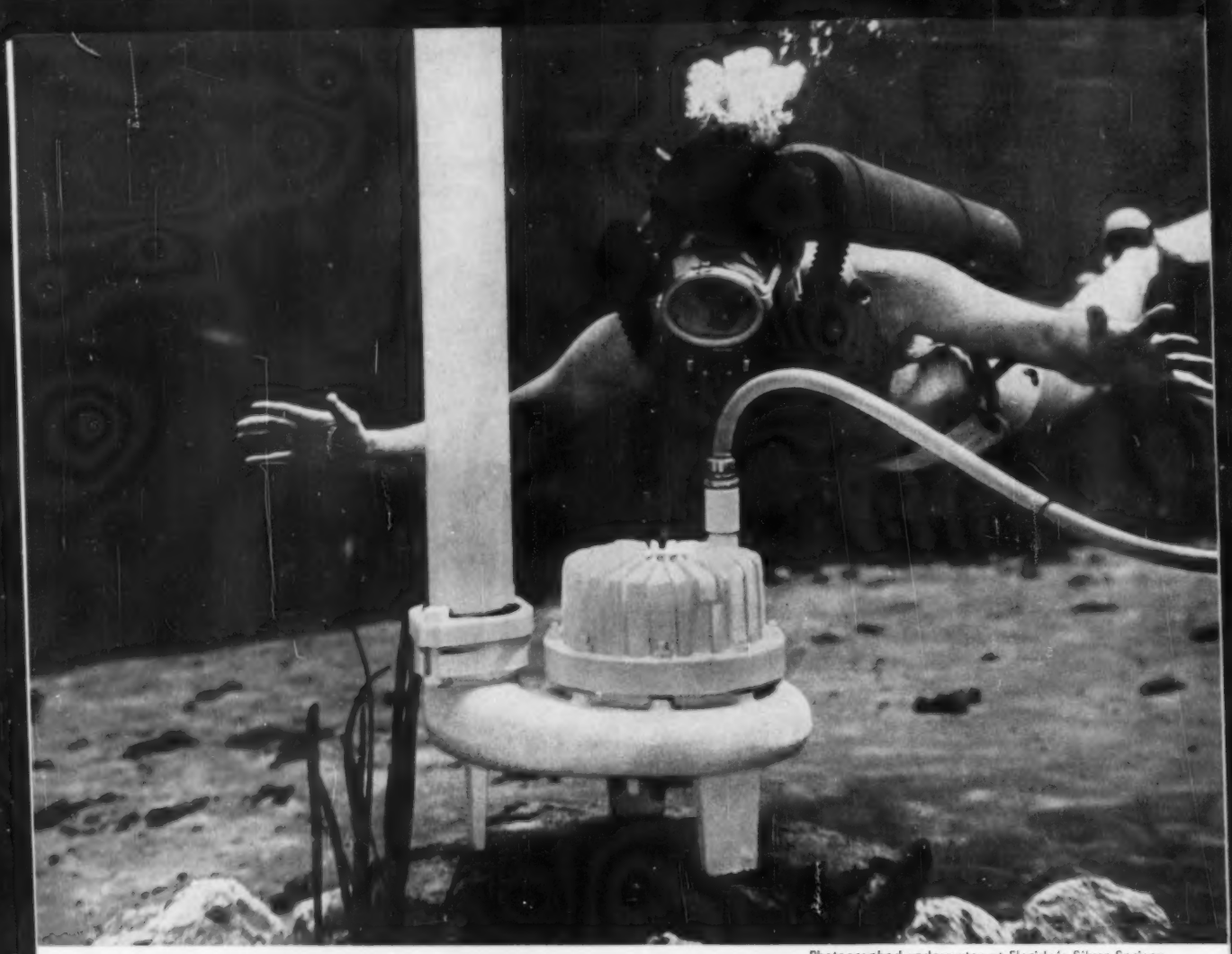
RESULT...NATIONAL LIGHTING LEADERSHIP

The addition of a strong new unit–Benjamin Electric Mfg. Co. –emphasizes the sound, rapid growth of Thomas Industries Inc.

The *Moe Light* and *Star Light* divisions of Thomas Industries hold positions as leaders in the fields of residential and decorative commercial fixtures; while *Benjamin* enjoys prominent stature in the fields of industrial and commercial lighting. Unquestionably, the combination of these three nationally advertised names brings Thomas new importance in all phases of the lighting fixture industry.

Never before has one organization offered so much to the efficient and attractive lighting of America's homes, stores, offices and factories!

Consistent with its new position in the industry, Thomas Industries Inc. pledges itself to continued concentration on product development, quality manufacture, aggressive advertising and progressive sales policies.



Photographed underwater at Florida's Silver Springs

Skin-diving demonstration shows what we mean when we say Sealtite flexible conduit is liquid-tight

The new Immersible Motor recently introduced by The Louis Allis Company demonstrated, at the bottom of Florida's famous Silver Springs, its ability to operate completely submerged.

Skin-diving right along with the motor was Sealtite Type E.F. flexible conduit, guarding the electric lines to the power source on dry land. The demonstration dramatically showed that Sealtite remains liquid-tight under unusual conditions.

The tougher jobs that Sealtite is designed for are less dramatic. Standing up under hot sun, rain, sleet, ice, through the seasons is harder. So is shrugging off oils, grease, corrosive fumes, chemicals, salt spray. Yet in mills, mines, process industries, Sealtite quietly keeps equipment operating dependably under conditions that would quickly knock out ordinary conduit.

Want to know more? Electrical Wholesalers stock Types U.A. and E.F.* Sealtite in easy-to-handle cartons or on reels in gray and black. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors. Free Booklet S-541 gives you full information on Sealtite. For your copy, write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada, Sealtite is approved by Canadian Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ontario.

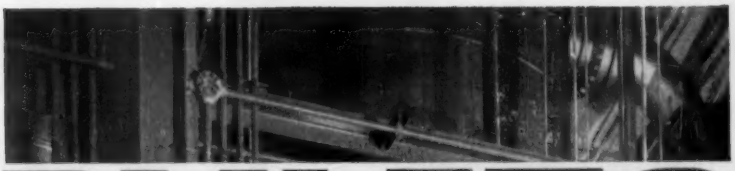
*Patent Applied For 58186

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket extruded over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

Insist on the conduit marked **SEALTITE®**

FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA®** *product*



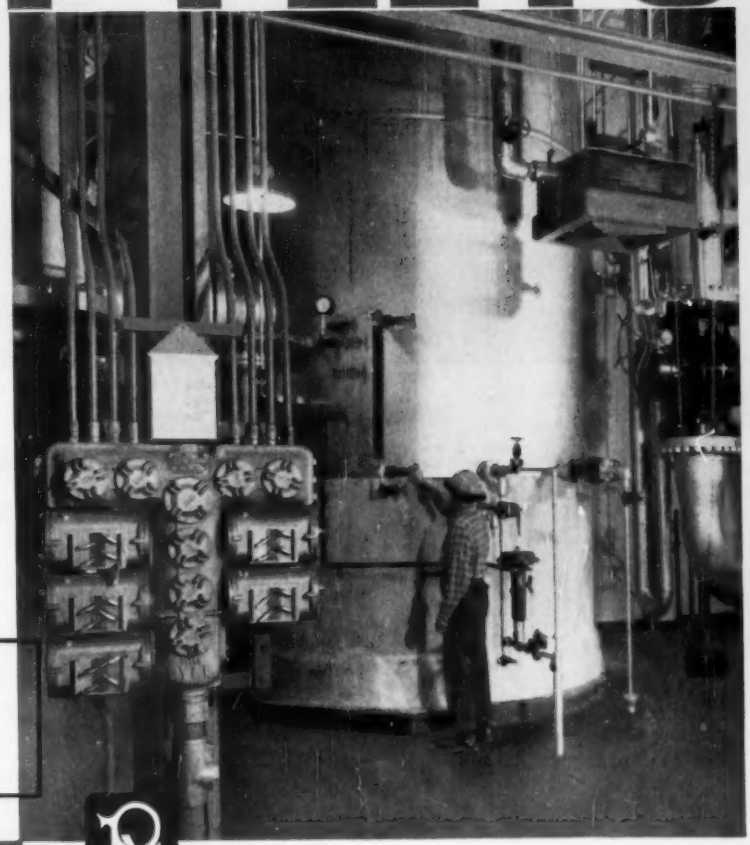
explosion-proof PYLETS®

specified for McMahon Gas Processing Plant Fort St. John British Columbia

Explosion-proof PYLETS exceed code requirements and provide maximum protection for personnel and property against explosion and fire.

PYLETS are designed for quick, easy installation and convenient maintenance. Rugged construction insures a long service life.

- **Taper tapped hubs**
- **Smooth, roomy interiors**
- **Quick acting joints**
- **Dependable Mechanisms**
- **Aluminum alloy or heavy cadmium plated ferrous alloy castings**



Pyle-National panelboard, lighting fixtures, and other Pylets in Absorption & Dehydrating building, McMahon Gas Processing Plant. Stearns-Roger Engineering Co., Ltd. specified Pyle-National controls, conduit fittings and lighting fixtures throughout.

GU SERIES ... ERC SERIES

SINCE 1897

Sold Nationally Through Authorized Distributors. Write for Literature.

THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1344 North Kostner Avenue, Chicago 51, Illinois

Branch Offices and Agents in Principal Cities of the U. S. and Canada
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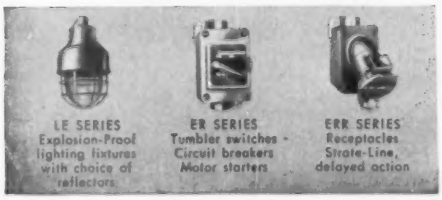
Industrial Export Department: Rocke International Corp., 13 E. 40th St., New York 16, N. Y.
Canadian Agent: The Holden Co., Ltd., Montreal

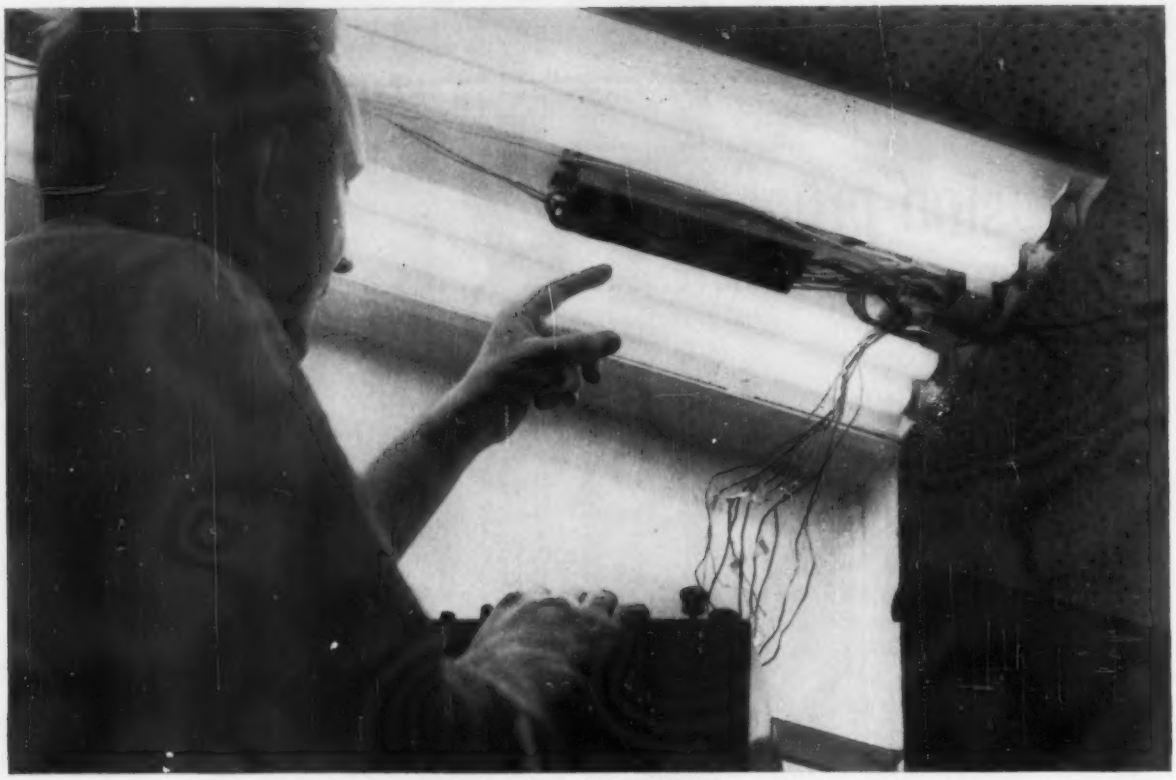


LE SERIES Explosion-Proof lighting fixtures with choice of reflectors

ER SERIES Tumbler switches · Circuit breakers Motor starters

ERR SERIES Receptacles Strate-Line, delayed action

CONDUIT FITTINGS • MOTOR CONTROLS • CONNECTORS • FLOODLIGHTS



New rapid-start ballast for two 40w lamps proved under severe test conditions

New cool Sola rapid-start ballast easily passes "in-fixture" heat tests

Sola engineers the ballast to be an integral part of the fixture rather than as an isolated component. This new ballast was consequently designed to pass exacting "in-fixture" tests, for superior performance under the most demanding operating conditions.

This new two-lamp, 40-watt, rapid-start ballast is built to allow a coil-temperature rise of only 42°C when tested according to U.L. and E.T.L. methods.

In our own laboratory the new ballast was installed in a four-lamp fixture, completely enclosed and surface-mounted on acoustical material. Temperature in the fixture channel was 18°C hotter than the usual 40°C ambient of U.L. and E.T.L. tests. The following impressive results were recorded:

- Maximum coil temperature was 89.3°C—15°C cooler than the limit of Class A insulation.
- Temperature of the capacitor's case was within the heat limits of the capacitor's insulation.
- The "hot-spot" temperature on the ballast case was 81°C — 5°C cooler than premium-priced ballasts similarly tested, 9°C cooler than the maximum allowed under U.L. fixture requirements.

Our new level of coolness in ballast case, coils and capacitor contributes to full ballast life. This premium performance is offered at no price penalty.

Sola will furnish fixture manufactures with samples of this new ballast (Catalog No. 670-109). Write to us on your business letterhead, and a Sola sales engineer will promptly supply your test ballasts. Sola welcomes the challenge of having you evaluate this cool new ballast in your own fixtures. If you wish merely to examine data on the new model, please request Bulletin FL-352. Write to the Manager, Lighting Sales.

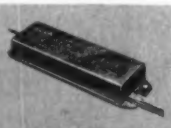
Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill., Bishop 2-1414 • Offices in principal cities • In Canada, Sola Electric (Canada) Ltd., 24 Canmotor Ave., Toronto 18, Ont.

SOLA

CONSTANT VOLTAGE TRANSFORMERS

REGULATED DC POWER SUPPLIES

MERCURY LAMP TRANSFORMERS

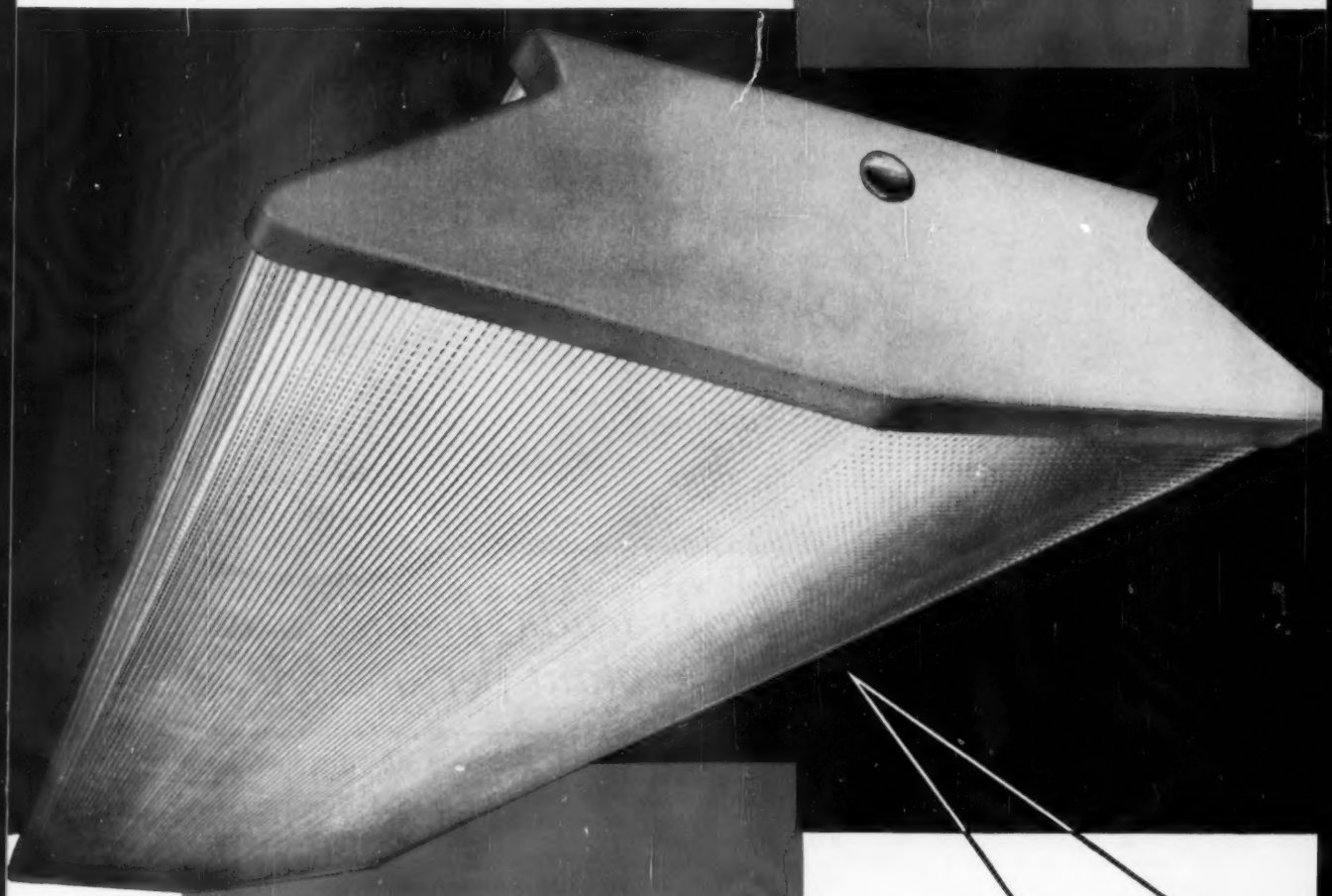


FLUORESCENT LAMP BALLASTS

A DIVISION OF BASIC PRODUCTS CORPORATION

Something Really *Different* in Fluorescent Lighting . . .

SABRE by miller



Here is a fresh approach to the design concept of *on-the-ceiling* fluorescent lighting. Sabre by Miller has styling, comfort, and high efficiency that meet the needs of modern stores, offices, and schools — interiors of all kinds.

Sabre's shallow depth and sweeping "Flite-Line" Styling blend to enhance the appearance and decor of any interior. *Efficiency of 74.5%* means fewer fixtures per footcandle are needed to make today's high lighting levels practical.

Sabre's carefully engineered, one-piece wrap-around refracter of prismatic, crystal-clear plastic provides added sparkle, and excellent brightness control. Viewing is comfortable from all angles. Maintenance is easy.

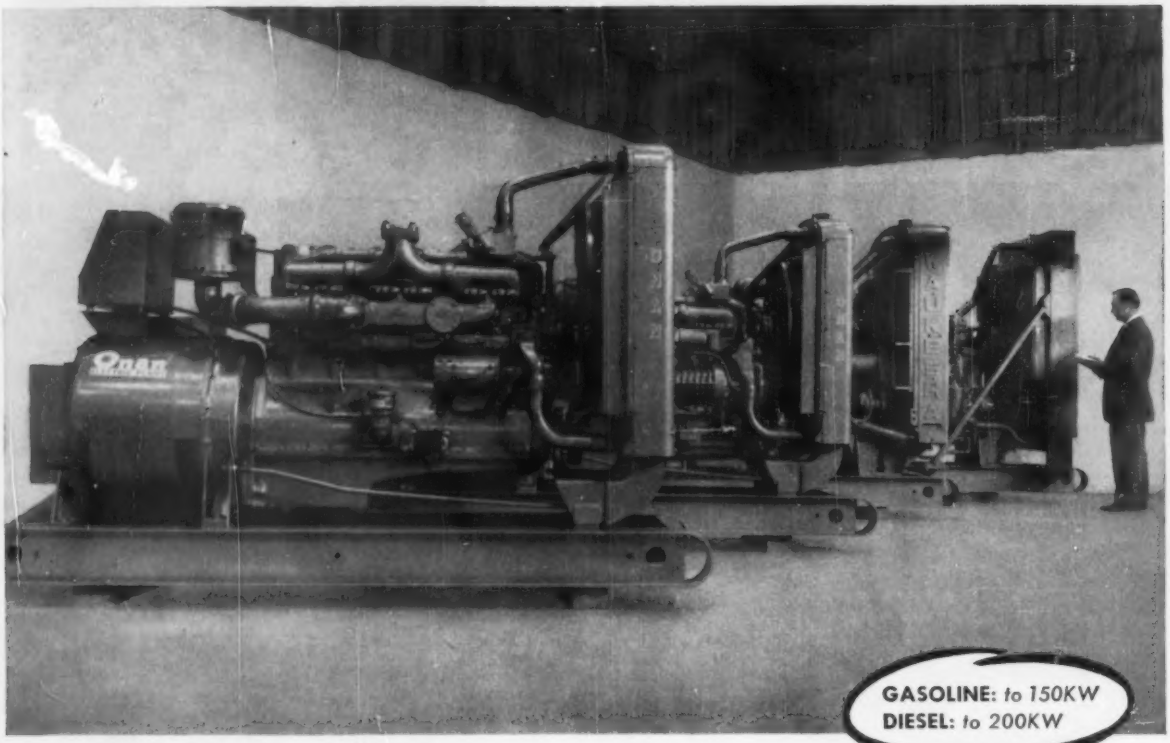
And, this unique combination of features comes at a truly popular price. Discover today, how the new Sabre can meet your specific lighting design and installation needs. Write Dept. 958-E, The Miller Company, Meriden, Conn. for complete performance and specification information, or contact your Miller Representative for a physical demonstration.

SABRE—(Trademark)

miller
SINCE 1844

THE **miller** COMPANY • MERIDEN • CONN.

Now...Onan Electric Plants to 200KW!



New Magneciter Generator leads "break through" to new high in electric plant performance*

Now you can have Onan engineering and Onan dependability in high-capacity plants, too! The leader for years in the design and production of small and medium-sized plants, Onan offers models to 200KW, built to Onan's high standards of performance.

In gasoline-powered models, 100, 125, and 150KW sizes have been added to the line. New diesel models start with 10KW and include 15, 25, 35, 50, 60, 75, 100, 125, 150, 175, and 200KW capacities. All standard voltages are available.

All models are powered by heavy-duty industrial engines carefully matched to the power requirements of the generator.

Custom modifications to meet the needs of particular applications add to the versatility of the new Onan line. Automatic controls for standby installations are available for each model.

All plants of 100KW and larger are equipped with the new Onan Magneciter. This new generator with static exciter and voltage regulator provides outstanding performance advantages for both standby and primary power installations.

**Onan alternator with static excitation and static voltage regulation through saturable reactors with magnetic amplifiers.*

Here are the advantages of the Onan Magneciter Generator

- **Simplicity**—Eliminates hundreds of electrical connections, commutator and its brush rig.
- **Constant voltage**—Voltage dip is less than 20% with motor starting load. Stable generator operating conditions re-established within 2 seconds after load is applied.
- **Lighter weight, more compact**—Plants are shorter by a foot or more, lighter in weight.
- **Less maintenance, easier servicing**—The static exciter and regulator are externally mounted and easily accessible.

Onan builds Electric Plants from 500 watts to 150KW A.C., gasoline-powered; 3,000 watts to 200KW A.C., Diesel-powered. Portable, primary, and standby models. D.C. battery chargers and separate generators also available.

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and specification information, or contact your Miller Representative for a physical demonstration.
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BLUE BEND-ALINER STRIPE

BLUE BEND-ALINER STRIPE

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- Order Steelduct for *your* next job. See how these features add up to a *subtraction* from your costs.

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THE BLUE BEND-ALINER STRIPE allows quick, accurate alignment of bends. Combined with a Steelduct Benfield Bender it makes tough runs easy.

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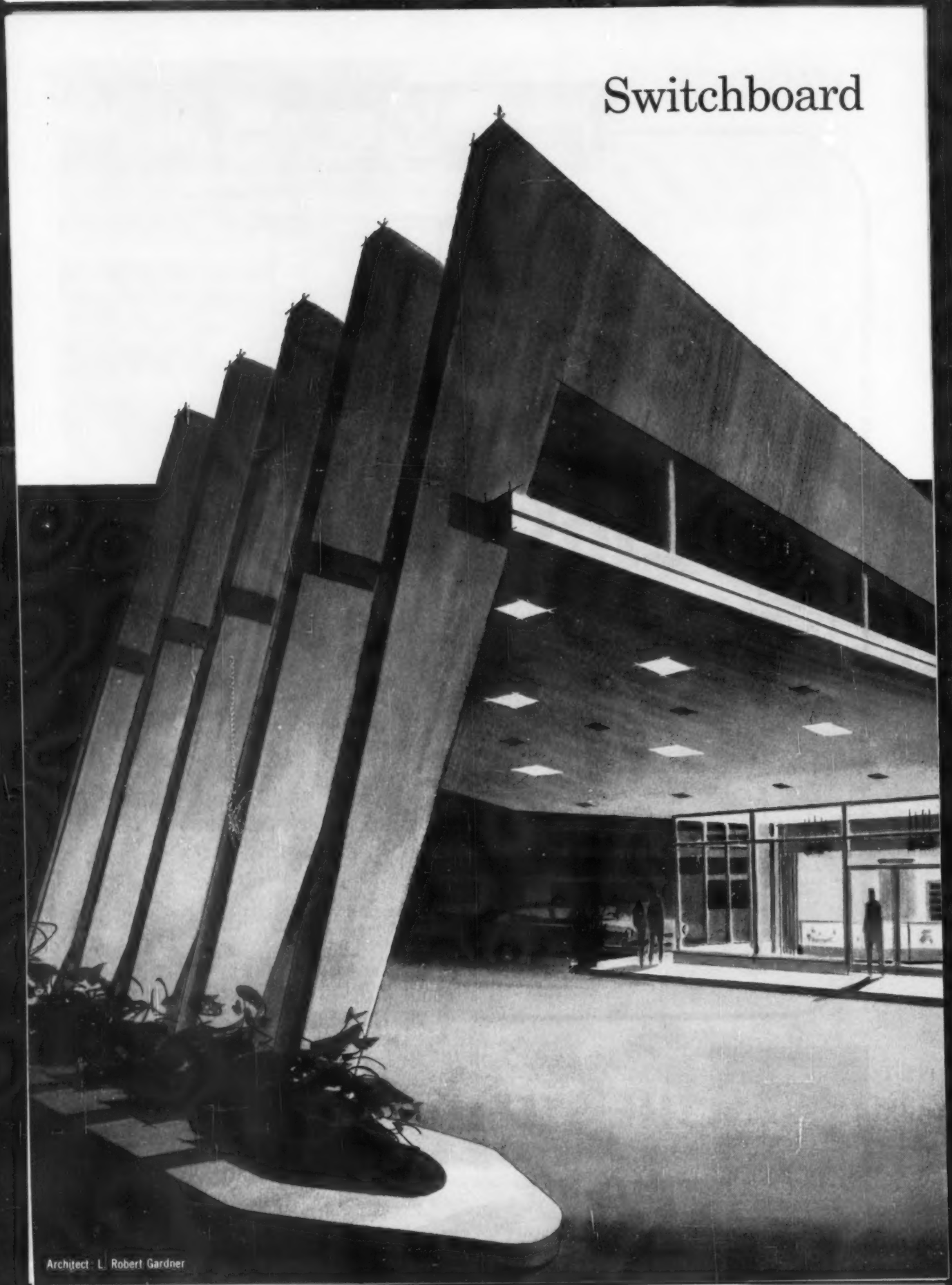
REPUBLIC STEEL BUILDING — YOUNGSTOWN, OHIO

Switchboard



Architect: L. Robert Gardner

planning helps Power-Up new motel

Westinghouse Local Service Aids Electrical Contractor

The new $3,500,000 Hotel Utah Motor Lodge, located just across Salt Lake City's Temple Square from the hotel, is designed to provide dining, swimming and other facilities sufficient to accommodate guests of both hotel and motor lodge.

Westinghouse equipment was specified for the electrical distribution system from the start in planning the motor lodge, because of the excellent performance of the existing Westinghouse installation at the hotel. The system was designed to provide maximum flexibility and ease of installation. Of equal importance to the contractor was the cooperation given by WESCO in coordinating delivery schedules to keep pace with actual construction.

In addition to the Westinghouse building-type switchboards, there are 55 panelboards in the motel, each of which controls anywhere from 20 to 42 individual lighting and convenience outlet receptacle circuits.

Westinghouse switchboard and panelboard planning can help in Powering-Up any installation you may make. For more information, call your nearby Westinghouse office, or write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

OWNER: Hotel Utah, Salt Lake City
ARCHITECT: L. Robert Gardner, Cedar City, Utah
CONSULTING ENGINEERS: Bloomquist & Brown, Salt Lake City
GENERAL CONTRACTORS: Jensen Construction Co., Salt Lake City
ELECTRICAL CONTRACTORS: Midwest Electric Co., Salt Lake City
WESTINGHOUSE DISTRIBUTOR: WESCO, Salt Lake City

J-93536-R

W. C. Brown and S. A. Bloomquist, of Bloomquist & Brown, Consulting Engineers (standing at rear), show main switchboard to Gerald B. Smith, Hotel Utah Building Superintendent, and Van Livingston, Motor Lodge Assistant Manager. This Westinghouse building-type switchboard distributes current through feeder circuit breakers to the 55 panelboards throughout the building.

YOU CAN BE SURE...IF IT'S Westinghouse

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Architect: L. Robert Gardner

NEW!

ROME *TRIMLINE** PRIMARY DISTRIBUTION SYSTEM

WITH A NEW SIMPLIFIED, STREAMLINED SPACER DESIGN!

A Practical Overhead System. Developed for utility and industrial distribution circuits ranging from 5 to 15 kv, Rome's TRIMLINE* system consists of (1) a unique and highly simplified Plexiglas supporting spacer, (2) extruded black, high molecular weight polyethylene insulated phase conductors (either one, two, or three phase), and (3) a high strength supporting messenger.

This economical method of overhead distribution is recommended for installations where:

- additional circuits are required on a pole
- poles are too crowded
- bad tree and storm conditions cause havoc with open-wire lines
- alleyways prohibit use of crossarms

. . . and especially where a *compact* and *neat-appearing* distribution system is necessary!

System Features New Spacer. Now . . . a new spacer design makes Rome's TRIMLINE* system as reliable as it is practical. The one-piece Plexiglas spacer offers distinct "reliability" features. It has no mating or matching surfaces to form cracks or crevices which collect water or other contaminants. This in turn reduces the possibility of eventual arcing or shorting.

Each spacer is equipped with four "snap-lok" neoprene grommets (adapters). Special molded-in compression rings in each grommet assure a snug spacer-to-cable fit. The constant pressure exerted upon the messenger and conductors restricts the spacer from "traveling" on the line.

The spacer itself is shaped like a diamond with rounded corners and smooth edges. When installed, each of the phase conductors and the messenger are completely contained within the encompassing spacer unit.

Installation of the spacer unit is performed with no tools or special equipment, requires *no* nuts or bolts. And maintenance is just as easy—phase conductors can be removed or added without removing the spacer from the messenger. Spacers are placed approximately thirty feet apart along the entire length of the distribution system.

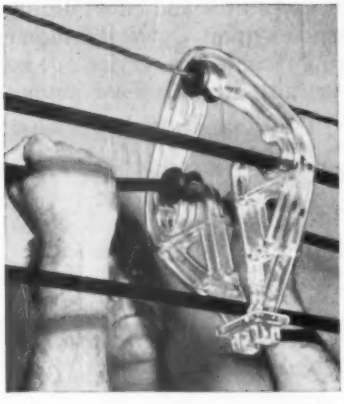
*T. M. (patent applied for)

HERE'S WHAT THE TRIMLINE SYSTEM OFFERS YOU:

1. A *single* spacer for 5 to 15 kv range.
2. Abrasion-resistant high molecular weight polyethylene insulation or other suitable materials as specified by the user.
3. Neoprene grommets with molded-in compression rings.
4. A spacer that completely encloses phase conductors and messenger.
5. A high strength supporting messenger that provides storm damage protection, thereby permitting . . .
6. Longer spans—the system messenger permits spans up to 300 feet.
7. Positive phase identification by position in spacer.
8. Lower reactance than conventional open-wire lines.
9. Ease of installation.
10. Neat, compact overhead distribution. Better public relations.

Send in the coupon for our new bulletin on Rome TRIMLINE* Primary Distribution System.

SEND FOR FREE BULLETIN!



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137 models to choose from . . . 30 to 200 ampere capacity

4330—Single 30 or 60 amp pullout units and units with 4 to 8 plug fuse circuits. Surface, flush and raintight enclosures.

4332—100 amp service parallel connected 60 amp main lighting pullout units with 8 to 12 plug fuse circuits. Two branch pullouts easily added. Surface or flush mounting enclosures.

4334—Series connected 60 amp main pullout and one or two branch pullout units with 4 to 8 plug fuse circuits. Complete line of enclosures.

4335—Parallel connected 90/100 amp service in 31 models. 4 to 12 plug fuse circuits and one to four branch pullouts.

4336—100 amp main pullout, series connected with two 30 or 60 amp branch pullouts. Up to 16 plug fuse circuits. Surface, flush and raintight enclosures.

4338—200 amp service, series connected main and branch pullouts. Up to 32 plug fuse circuits with two branch pullouts and 24 plug fuse circuits with four branch pullouts. Full line of enclosures.

4383—2 to 20 plug fuse panels ranging in capacity from 30 to 100 amps. Available in either flush or surface mounting enclosures.

The Cutler-Hammer line of Fusible Service Entrance Equipment offers 137 different models ranging from a single 30 ampere pullout to a 200 ampere service center with a main pullout, 30 and 60 ampere branch circuit pullouts, and up to 32 plug fuse circuits . . . in your choice of flush or surface mounting and raintight enclosures. A Cutler-Hammer Service Control Unit meets your job requirements best.

Your nearby Authorized Cutler-Hammer Distributor carries a balanced stock of this service entrance equipment. He can give you immediate delivery and save much valuable time you might waste "shopping" for a substitute unit elsewhere.

Cutler-Hammer, nationally advertised in such magazines as TIME and NEWSWEEK, is recognized by all as a manufacturer of dependable control products. Cash in on this "customer acceptance" and build a reputation for installing the very best in service control equipment.

Cutler-Hammer Fusible Service Control is tops in economy too . . . priced with the lowest, saves time and effort during installation. And you can depend upon Cutler-Hammer Service Control for longer lasting trouble-free service . . . no nuisance service calls. See your Authorized Cutler-Hammer Distributor now, or write for the Cutler-Hammer Merchandiser ES-100-B241, the handy selection guide. CUTLER-HAMMER Inc., Milwaukee 1, Wisconsin.

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Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation, Inc.

58TH YEAR • JANUARY 1959

Electrical Construction and Maintenance

Toward Safety in Schools

Last month in Chicago, a parochial school fire took the lives of 87 children and three nuns. Experts from all phases of fire prevention activity converged on the scene. Crash programs of school inspections have followed from coast to coast. And we can be sure that all of our existing fire safety practices in school buildings are in for a critical review.

Whatever the findings of the authorities as to the origin of the disaster, the fact that it could happen at all, in any school, puts the responsibilities of the electrical industry in a new prespective. Are our schools equipped with the best modern electrical equipment and safety systems we know about? Unfortunately they are not.

What about fire detection? Automatic fire detection and alarm systems are widely available. Yet how many schools are equipped with this modern and now indispensable system? How many school plans and specifications now on the boards include any kind of automatic fire detection, location and warning in their electrical systems?

And what about school heating? Modern electric heating systems are the safest form of space heating ever developed. They are inherently incapable of starting a fire or contributing energy or materials to a fire of other origin. They are fail-safe. They involve no combustion nor do they require a source of combustible fuel. They are fully automatic, self-controlling and require no custodial care or supervision.

Safe, modern, electric heat can be installed in our schools today in almost any community, at a reasonable cost for installation and operation. Critical comparisons of operating costs with fuel fired systems, which inevitably occupies the center of discussion, become relatively academic if we consider the incomparable safety and performance of electric heat.

The electrical industry can take prompt and constructive action to improve the safety of our schools by advocating and supporting the immediate installation of automatic fire warning systems. And the installation of safe electric heating systems—in new schools and to replace obsolete facilities in existing schools—should be accelerated to a major industry program as quickly as possible.

Wm. T. Stuart

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Outlook for '59

High volume in new construction, a potential boom in electrical modernization and rising electrical loads required for modern utilization concepts will push electrical industry activity to record levels this year.

ELECTRICAL construction, installation and maintenance activity in 1959 should exceed last year's level by 10% or more. This favorable outlook is supported by the Department of Commerce forecasts of new construction for the coming months, the imminent obsolescence of over-age wiring systems in existing buildings under the pressure of increasing loads, and new electrical demands arising from advancing standards in illumination and electric heating.

New Construction

Spending for new construction is expected to rise 7% to a record $52.3 billion in 1959, thus passing the $50-billion mark for the first time, according to outlook estimates prepared jointly by the Departments of Commerce and Labor.

Public expenditures are expected to provide the major part of the 1959 expansion in new construction—rising by $2.1 billion to $17.1 billion. The $35.2-billion foreseen for private construction represents a gain of $1.4 billion over 1958.

Most of the $3.5-billion increase in construction expenditures in sight for 1959 will be in residential building (public and private) and highways, which together will account for almost four-fifths of the advance over 1958. The outlook is that approximately 1,200,000 new nonfarm dwelling units (private and public) will be started in 1959, compared with about 1,170,000 in 1958. Construction costs are expected to rise moderately.

An 11% advance in total new residential expenditures is anticipated during the coming year—from $18.5 billion to $20.6 billion. The gains in residential building over 1958 will come mainly from a 13% ($1.7 billion) increase in expenditures for new private nonfarm dwelling units to $15.0 billion. In addition, spending for publicly owned housing will exceed the billion-dollar mark for the first time, rising by almost $300 million to $1.1 billion. Additions and alterations to housing will probably rise also after a mild 1958 downturn.

For the second successive year, private nonresidential building construction as a whole will decrease, due primarily to a further decline in industrial building. The 3% loss reflects sharply diverse trends among various types of building.

Outlays for new manufacturing plants, which are expected to be down 15% from 1958, will be influenced largely by the sharp reduction in the number of new projects started last year.

Aggregate spending for commercial buildings will match the 1956 record of $3.6 billion.

Expansion in shopping facilities is expected, influenced by improved availability of financing in 1958, as well as the present rapid extension of highways, continued growth of suburban areas, developing urban renewal and high retail sales.

Other types of nonresidential building will, in general, be at or near record in 1959. Construction of churches and related facilities which, after five years of steady upturn leveled off in 1958, gives promise of moving ahead substantially (10%) and will approach the $1 billion mark. The dollar volume of private educational building will rise about as much as this year to an alltime high of $600 million.

Electrical Work
(millions of dollars)

	1957	1958	1959
Private Funds			
Residential	692	754	830
Industrial	498	368	435
Commercial and Institutional	703	773	836
Utilities	397	437	465
Farms	84	91	96
Other	9	84	90
Total Private	2,383	2,507	2,752
Public Funds			
Residential	16	27	31
Industrial	71	59	68
Educational	356	384	435
Institutional	87	93	101
Military	34	31	32
Highway, conservation	240	278	286
Other	27	34	35
Total Public	831	906	988
Total New Work	**3,214**	**3,413**	**3,740**
Modernization and Repairs	**830**	**920**	**1,040**
TOTAL	**4,044**	**4,333**	**4,780**

Private hospital and institutional construction will remain virtually at the $600 million peak in prospect for this year.

Construction outlays by public utilities were down slightly in 1958, and are expected to show a further 3% decline in 1959 to $5.4 billion. Expenditures for electric power and gas facilities, the major areas of spending, will each decline about 7% from this year's record.

Well over half the $2.1-billion advance in public construction outlays in 1959 will be financed by the Federal Government. Anti-recession measures and re-evaluation of defense programs resulted in acceleration of projects, rising contract awards, and large appropriations during 1958, which will result in sizable increases in the amounts spent on direct Federal and Federal-aid construction in the coming year. All types of public construction are expected to rise, however, bringing the total to a record $17.1 billion.

The largest percentage increase among types of public work, and the third largest dollar increase ($240 million), is expected for public service enterprises.

New Construction Put in Place in Continental United States 1957, 1958 and Outlook for 1959[1]

Type of construction	Value (in millions)			Percent change
	1957	1958[2]	1959	1958–59
Total new construction	**$48,115**	**$48,800**	**$52,300**	**+ 7**
Private construction	**33,988**	**33,800**	**35,200**	**+ 4**
Residential buildings (nonfarm)	17,019	17,700	19,500	+10
New dwelling units	12,615	13,300	15,000	+13
Additions and alterations	3,903	3,780	3,880	+ 3
Nonhousekeeping	501	620	620	0
Nonresidential buildings (nonfarm)	9,556	8,730	8,500	− 3
Industrial	3,557	2,460	2,080	−15
Commercial	3,564	3,550	3,630	+ 2
Office buildings and warehouses	1,893	1,980	1,900	− 4
Stores, restaurants and garages	1,671	1,570	1,730	+10
Other nonresidential buildings	2,435	2,720	2,790	+ 3
Religious	868	865	950	+10
Educational	525	565	600	+ 6
Hospital and institutional	525	605	600	− 1
Social and recreational	311	425	420	− 1
Miscellaneous	206	260	220	−15
Farm construction	1,590	1,600	1,600	0
Public utilities	5,624	5,575	5,400	− 3
Railroad	406	300	325	+ 8
Telephone and telegraph	1,068	900	950	+ 6
Electric light and power	2,100	2,250	2,100	− 7
Gas	1,650	1,750	1,625	− 7
Other public utilities	400	375	400	+ 7
All other private	199	195	200	+ 3
Public construction	**14,127**	**15,000**	**17,100**	**+14**
Residential buildings	506	830	1,125	+36
Nonresidential buildings	4,503	4,625	5,075	+10
Industrial	473	370	375	+ 1
Educational	2,825	2,880	3,000	+ 4
Hospital and institutional	350	400	475	+19
Administrative and service	439	530	750	+42
Other nonresidential buildings	416	445	475	+ 7
Military facilities	1,322	1,210	1,400	+16
Highways	4,971	5,350	6,000	+12
Sewer and water systems	1,344	1,390	1,520	+ 9
Sewer	781	840	950	+13
Water	563	550	570	+ 4
Public service enterprises	393	450	690	+53
Conservation and development	971	1,000	1,080	+ 8
All other public	117	145	210	+45

[1]Joint estimates of the Department of Labor and the Department of Commerce.
[2]Last 2 months estimated.

Modernization

Modernization of electrical systems and facilities in existing buildings accounts for a growing proportion of total electrical construction activity. Demands for modern electrical facilities such as air conditioning, adequate lighting and new appliances are running far ahead of the limited capacity of electrical systems installed for relatively smaller loads of the past.

While modernization will be strongly encouraged by industry promotion through the year, a large part of the demand will be compelled by acute necessity: the purchase of appliances, air conditioning systems, and, in commercial and industrial building, the inevitable overloading of feeders and other major components of the existing systems.

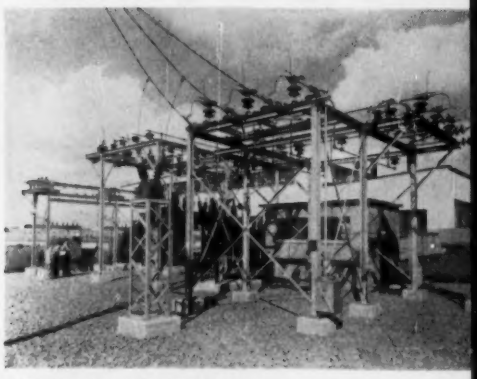
New Loads

Hot spots in the prospects for advancing load requirements are appearing in two areas. The impact of the Blackwell studies in illumination which resulted in a broad increase in recommended standards of lighting application will begin to be felt in electrical system designs this year. The increased encouragement of electric heating by utilities through promotion and attractive rate schedules is expected to add more than 100,000 new installations to the approximately 370,000 homes now heated with electricity. And a breakthrough in the application of electric heat to commercial and institutional buildings, particularly schools, could come at any time.

In signal and communication systems for schools, two applications appear due for rapid expansion this year. An outstandingly successful vandal alarm system installed in seven schools in Hackensack, N. J., has attracted nationwide attention with at least one major city now equipping all of its schools with a similar system. Automatic fire detection and alarm system installations are certain to follow the Chicago parochial school disaster.

Pressurized Control Center

Relays, contacts and rotating elements operating in dust-free environment reduce maintenance and boost production in progressive East Coast tube mill. Electrical installation, installed jointly by Emerson-Garden and Beach Electric of N. J., also features extensive trench system for underground and underfloor distribution of power.



OVERHEAD STRUCTURE of substation is link in utility loop distribution system, permitting power to be received through either 3-phase segment. Leads from two terminal poles are secured by strain insulators, incoming taps then proceeding to related station components through motor-operated horngap switches equipped with grounding blades.

By Henry W. Kragh, *Asst. Chief Electrical Engineer, Wigton-Abbott Corporation, Plainfield, N. J.*

CENTRALIZED location of all interior substation and control equipment; complete segregation of same in a separate 2400-sq-ft room; provision of filtered air under positive pressure; and an extensive trench system to facilitate wiring are several important reasons why The Triangle Conduit & Cable Co.'s Copper Tube Mill located in New Brunswick, N. J., is rated as one of the more progressive industrial plants in that state.

All of these features were planned with a purpose. For example, the provision of filtered air under slight positive pressure prevents the entrance of deleterious air-borne particles from the industrial plant proper. This insures a dust-free environment in which delicate relays, contacts and rotating elements can more effectively operate. This, in turn, lessens maintenance, results in fewer production interruptions and thereby reduces overall operating costs.

Provision of this pressurized air is through a ventilation penthouse constructed directly above the switchgear room, with air intakes admitting both (1) fresh outside air through louvered storm ports and (2) regulated amounts of recirculated air from the plant itself. In both instances, motor-operated dampers are automatically regulated by solenoid switches and temperature controls located outside as well as inside the plant.

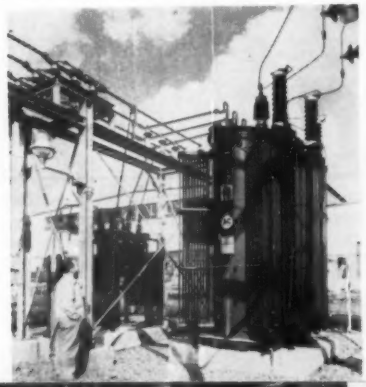
Air from these various intakes then passes through filter banks, is blended by a 2-speed 20-hp 440-volt 3-phase horizontal-blade centrifugal fan, and is then emitted directly into the switchgear room beneath, through banks of adjustable ceiling registers.

The positive pressure maintained within this critically important area is in the order of a half-pound, this "head" being regulated by automatic dampers (set into the common wall between switchgear room and production plant) which are controlled by pneumatic static-pressure regulators and graduated relays.

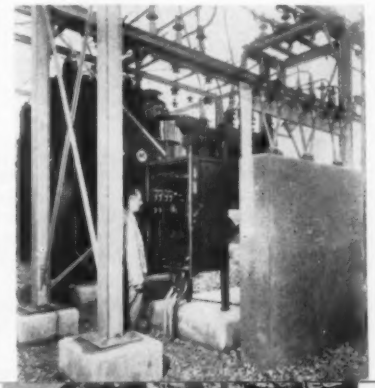
Air circulation within the plant proper is further promoted through the medium of 14 5-hp roof ventilators while, to obtain winter comfort, 30 blower-type electric unit heaters, complete with magnetic contactors, selector switches, thermostats, and manual thermal switches, are installed at truss level.

The underground trench system likewise was planned purposefully

VOLTAGE IS STEPPED from 26.4 kv to 4360 volts for basic plant distribution through this 3750-kva transformer, which is equipped with provisions for forced-air cooling to raise rating at later date. Space provisions and overhead structure were also planned to include subsequent installation of two additional transformers of the same size.



SOLENOID-OPERATED OCB having IC of 250,000 kva is activated remotely by 125-volt dc control. Concrete pier in right foreground encases bushed, calked ducts that carry power underground through 5-kv varnished-cambric lead-sheathed cables into interior substation of plant, where they are protected by 150MVA IC breakers.



BREAKER with million-kva IC is interlocked with 34½-kv motorized horngap switch at primary service entrance of plant substation. Connections are via 500 MCM bare copper cables equipped with standard end connectors and tees, while primary bus structure is formed from 1½-in. IPS copper tubing. Elevated metering PTs and CTs in right foreground are connected to related panels inside brick control house.

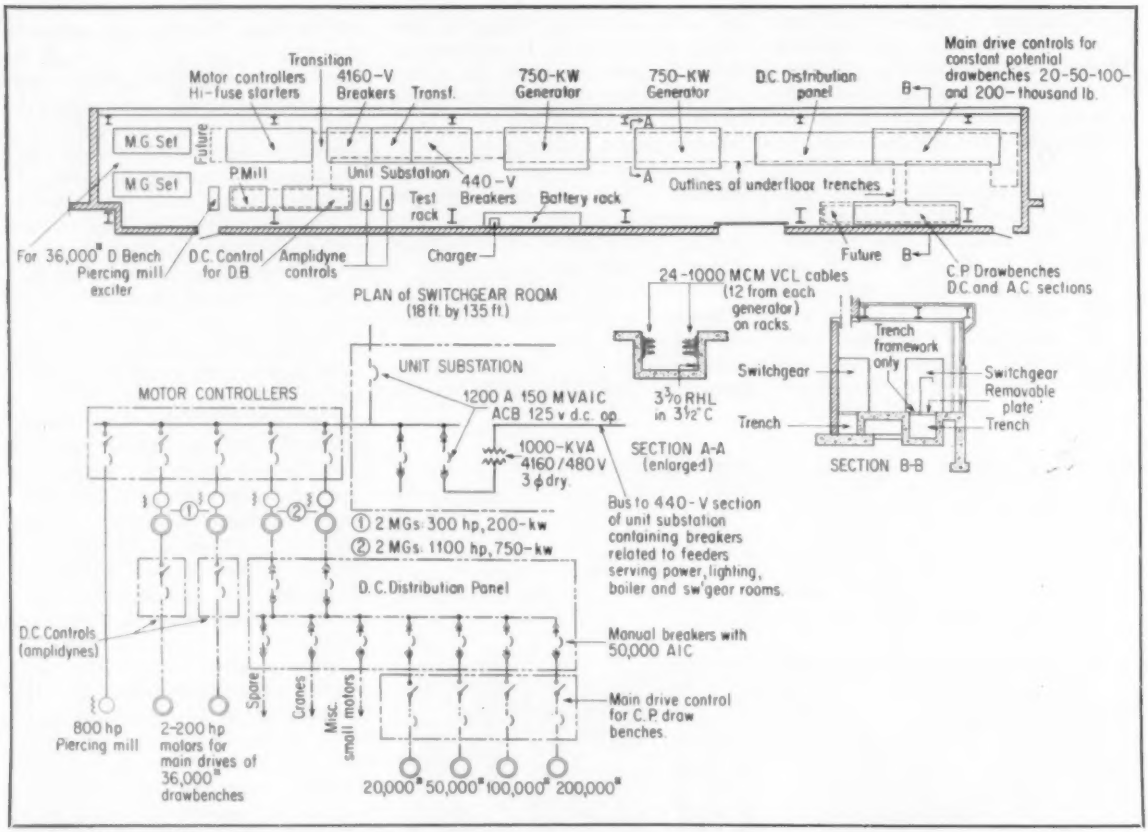
to simplify, conceal and more-easily route hundreds of circuits connecting equipment located within this central switchgear room with related assemblies, with primary feeds entering from the main exterior substation, or with the mass of heavy-duty production equipment located in the plant. As indicated by an accompanying sketch of the 135-ft-long switchgear room, this trench system is extensive. It underlies not only the complete interior substation assembly, but a group of five high-fuse controllers related to 4160-volt motors, two 750-kw generators arranged for parallel operation, a large dc distribution panel related to the control of said generator output, constant-potential main and auxiliary drive controls, plus dc and amplidyne controls related to two 36,000-lb draw-benches.

While it is not within the scope of this article to discuss wiring connections of equipment specifically, it is of general interest to note that, since the two 750-kw generators are arranged for parallel operation, it was necessary to insure that the resistance of output leads between the generators and the dc distribution panel were equal. Therefore the longest lead was installed first; the resistance of the three leads was measured, the cable for the nearest generator was cut so that its length would obtain the measured resistance, then extra lengths of the various leads were looped and racked along the walls of the trench.

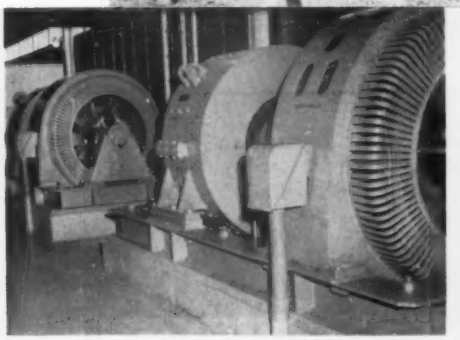
Cables, carried through these various trench segments, are supported on approved racks, brackets of which are mounted in vertical supports anchored to trench walls by expansion bolts.

Circuits entering or leaving the switchgear trench do so via underfloor and underground conduit banks, one such bank containing 115 conduits in a common installation.

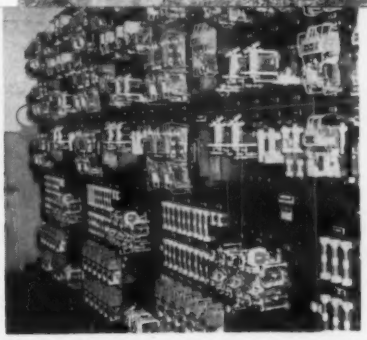
Control circuiting related to tube-mill draw-benches is integrally connected to high-voltage motor start-



COMPLETE SEGREGATION of interior substation and control equipment is obtained by installing same in separate switchgear room maintained under slight positive air pressure to preclude infiltration of contaminations from production areas. Extensive trench system facilitates interconnection of related assemblies with primary feeders from exterior substation and with heavy-duty production equipment in plant manufacturing areas.



TWO 750-KW GENERATORS with 1100-hp drive motors are arranged for parallel operation. Therefore, to keep resistance of output leads between generators and dc distribution panels equal, longest lead was installed first and remaining leads were measured and cut to obtain desired results. Extra lengths of middle and nearest cable connections were then looped along trench walls.



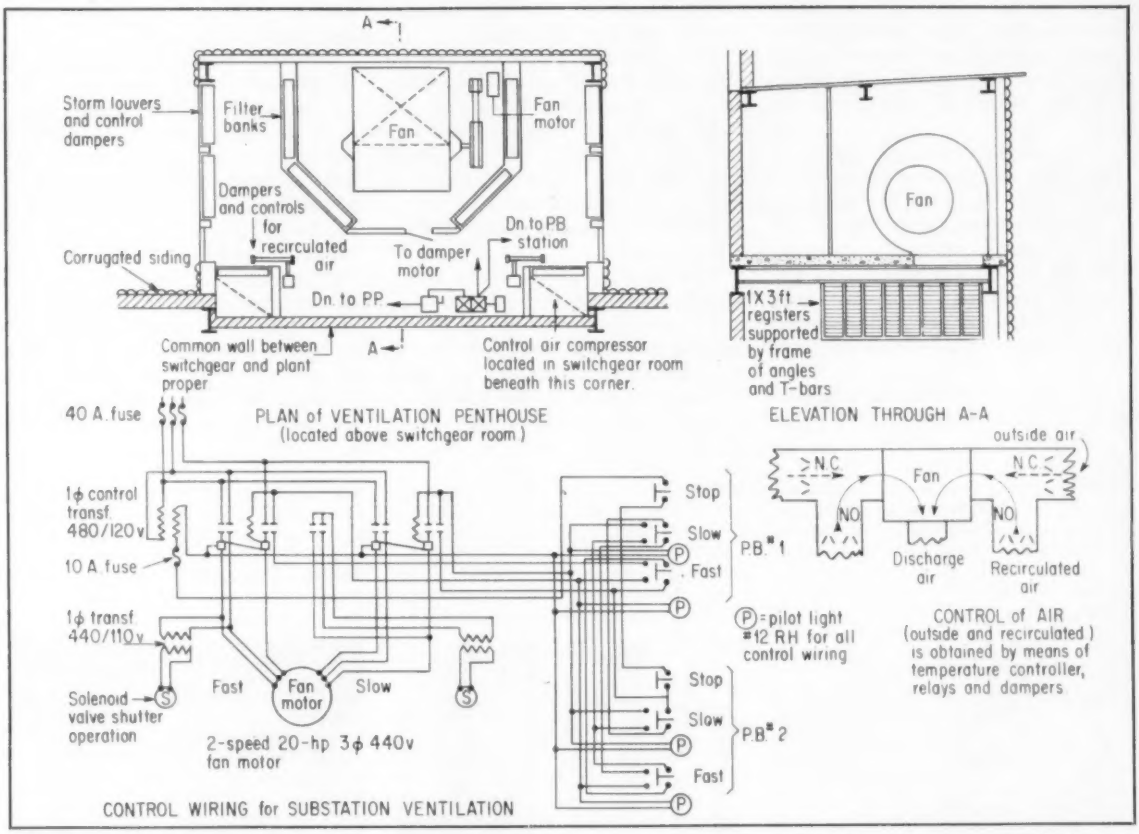
IMPORTANCE of filtered air maintained under positive pressure to exclude dust and dirt from switchgear room is effectively emphasized by delicate relays and contacts on this control board related to the main drive of 20-, 50-, 100- and 200-thousand-pound constant-potential draw-benches in the tube mill. Both ac and dc sections are combined in this assembly of switchgear.

ers and control panels via terminal strips. Connection of power leads is by means of studs provided for that purpose. Local control of draw benches (and piercing mills as well) is from free-standing operator desks or "pulpits" that contain a multiplicity of necessary selector switches, push-buttons and indicating lamps.

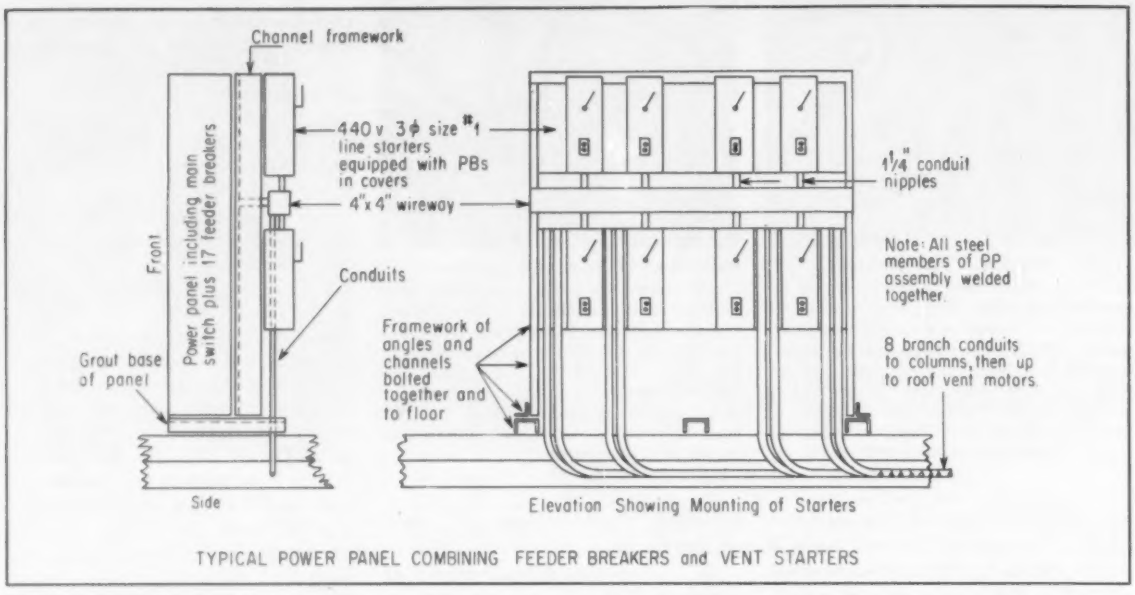
All conduits terminating at trench wall-lines are equipped with insulated bushings, while conduits are also bonded to each other and to the plant's general grounding system by means of approved clamps and bare stranded copper cables. Grounding within the general environs of the switchgear room likewise includes all components of m-g sets, all sections of switchgear and control panels, plus all frames and structures related to electrical equipment.

Referring to the interior grounding system of the plant in general, it is pertinent to stress its scope, for (1) ground clamps and cold-water piping are fabricated from the same type of metal so as to minimize the possibility of galvanic action, (2) a grounding jumper bypasses the main meter, (3) the system includes buried electrodes, ground rods and all steel building columns as well as the water piping, and (4) all attachments, to any of these grounding mediums, are by means of brazed cable connections. An accompanying sketch details these connections.

Due to the magnitude of electrical loads involved in production requirements, considerable underground distribution is at 4160 volts,



POSITIVE PRESSURE is maintained within interior substation and control center by means of 2-speed 20-hp centrifugal fan, automatic dampers on outside and recirculating air intakes, thermostatic and pneumatic static-pressure controls. Pressure, amounting to half-pound above atmospheric, prevents unfiltered air from production area to enter switchgear room, maintaining dust-free atmosphere for efficient operation of relays, contacts and rotating elements.


Channel framework
440 v 3ϕ size #1 line starters equipped with PBs in covers
4"x4" wireway
1¼" conduit nipples
Front
Power panel including main switch plus 17 feeder breakers
Conduits
Note: All steel members of PP assembly welded together.
Framework of angles and channels bolted together and to floor
Grout base of panel
8 branch conduits to columns, then up to roof vent motors
Side
Elevation Showing Mounting of Starters
TYPICAL POWER PANEL COMBINING FEEDER BREAKERS and VENT STARTERS

TYPICAL POWER PANEL installed in tube mill consists of channel and angle framework welded together and then bolted to floor and grouted as shown. Front of panel encloses main switch and feeder breakers, while line starters equipped with pushbuttons in their covers are mounted to rear of framework. Main wiring artery for starter connections and branch circuitry is square wireway mounted horizontally as indicated.

5-kv varnished-cambric insulated lead-sheathed cables extending between outdoor and indoor substations and between control panels and the 4160-volt motors in the plant.

All buried conduits carrying 4160-volt feeders are encased in red colored concrete envelopes as a distinctive warning. Banks of four or more conduits carrying 600-volt wiring are encased by uncolored concrete, while all other buried conduits are protected by fibrous bituminous compound coverings.

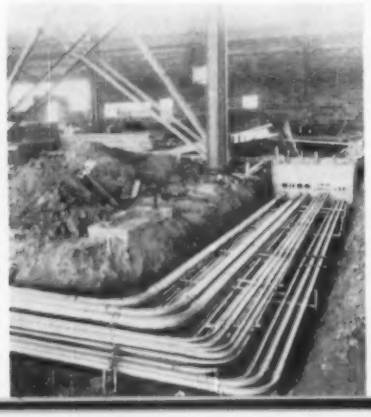
All buried conduits are carried at least a foot beneath the level of finished floor slabs, and 2 ft beneath outside ground elevations.

Over 100 miles of cable are involved in this underfloor and underground distribution system; the 5-kv cables so used having two additional layers of varnished cambric, and 600-volt circuiting being via rubber-and-lead dual-rated wiring having either TW or RW insulation.

Identification of circuiting is unusually complete for, in manholes and trenches as well as in above-ground junction and pull boxes, tags and plastic markers are used to designate current characteristics, voltage levels, machines being served by the circuits and terminal designations as well.

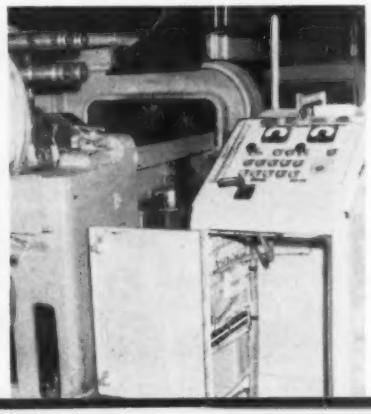
Primary power at 26.4 kilovolts is insured against interruption due to the fact that the overhead structure of the plant's main exterior substation forms a link in a utility loop system, thereby permitting power to be received through either of two 3-phase 3-wire overhead lines. Connections with the two loop segments terminate at independent banks of strain insulators mounted atop a common substation structure, the incoming leads then proceeding to station components through 600-amp 3-pole 34½-kv motor-operated horngap switches

LOOKING into trench beneath main drive controls for CP draw-benches shows concentration of connecting cables related to these heavy-duty units. Continuations of trench underly most major items of equipment in the 135-ft long centralized switchgear room.



SCOPE of underfloor and underground distribution necessitated installation of major conduit banks that involved up to 115 raceways in single grouping and combined cable lengths exceeding 100 miles. All buried conduits are positioned at least a foot below the finished floor.

CONTROL CONSOLE for operating piercing mill is slope-mounted atop metal enclosure containing all related wiring and selector switches. Meters, pushbuttons, indicating lights and control levers are conveniently grouped on the inclined top for easy operation.



equipped with interlocked grounding blades.

Horngaps having similar characteristics likewise flank and are interlocked with a main OCB rated for an interrupting capacity of a million kva and solenoid-operated by 125-volt dc coils.

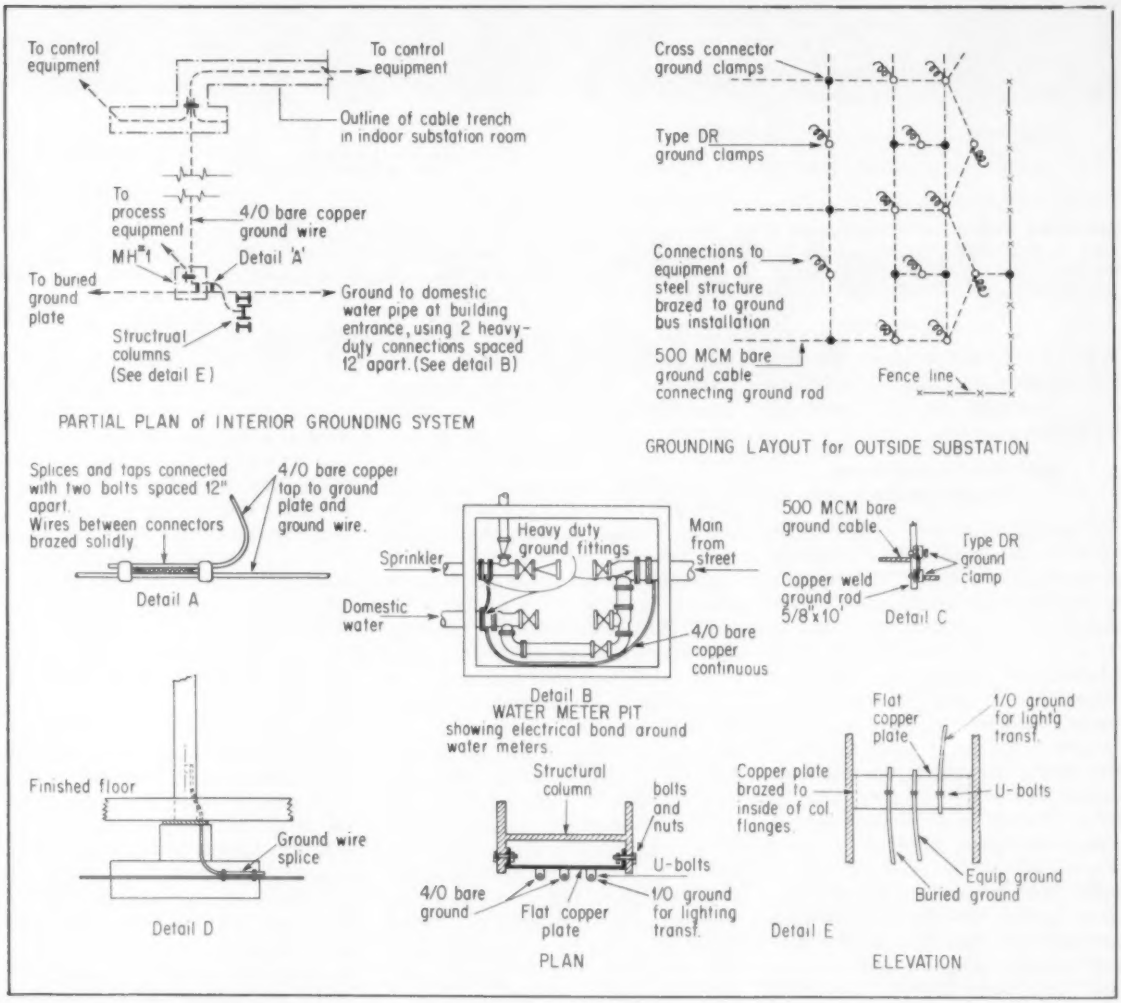
At present, total power for the multi-function industrial center (of which the here-discussed copper tube mill is but one of several units) is handled by a single 3750-kva 26.4-kv/4360-volt 3-phase unit, although provisions exist for boosting this capacity through the medium of future forced cooling, and space provisions also exist for installing two additional transformers as separate service units for independent wire and conduit plants.

Power at the stepped-down level of 4360 volts is carried through a second 1200-amp 250,000-kva IC solenoid-operated OCB and then through potheads to a concrete riser which encases bushed and calked ducts that proceed underground and thence into the interior substation previously discussed.

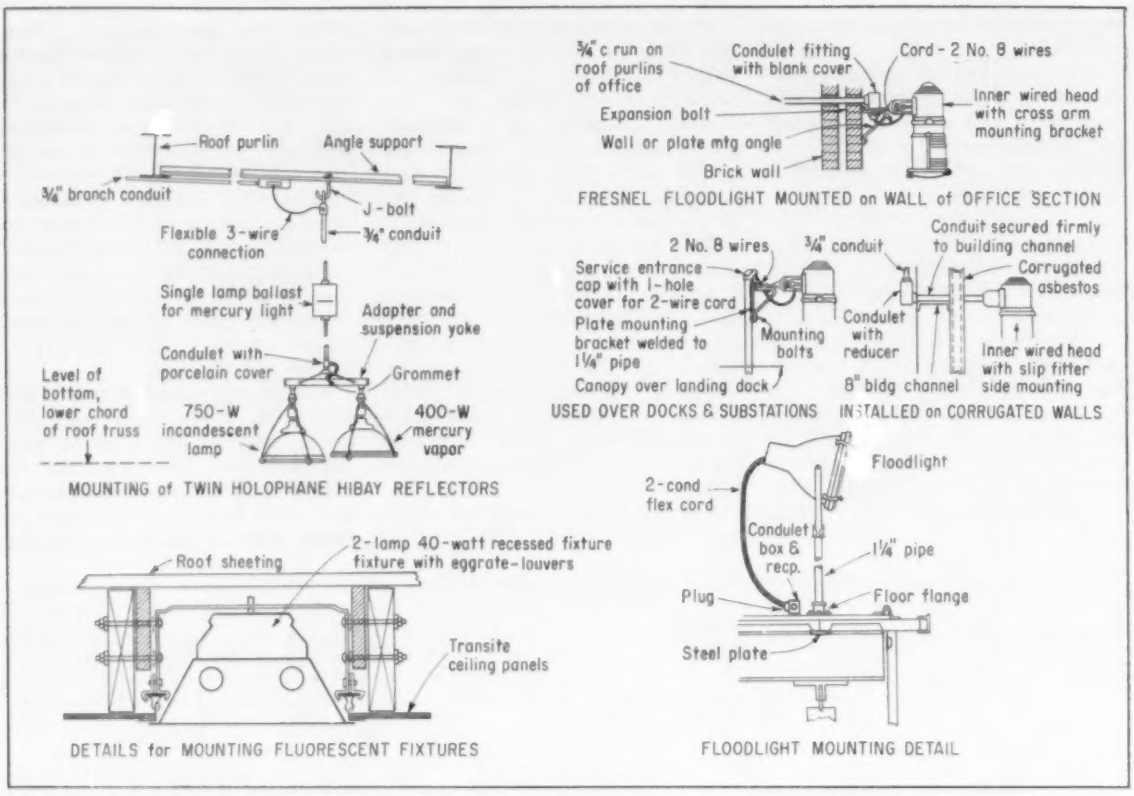
This exterior station is a prefabricated assembly that includes a complete complement of factory-matched transformers, switches, circuit breakers, rectifiers and battery racks. The steel structure was likewise factory-equipped with anchor and erection bolts, connectors and cables, cap and pin supports, tee connectors, ground clamps and lighting units.

The overhead common bus structure (that connects with the two utility loop segments) is formed from 1½-in IPS copper tubing, while 500MCM bare copper cables are used as primary connections and also to form a grounding network. As indicated by an accompanying sketch of grounding details, this exterior installation involves the use of numerous copperweld rods, brazed connections to components of the steel structure, clamps at all ground-cable cross-connection points, and double clamps where ground cables connect to driven rods.

Control and metering panels pertaining to this outdoor substation are housed in an adjacent brick building that also contains the operating battery, a related charger and space heater. Connections between interior panels and exterior


To control equipment
To control equipment
Outline of cable trench in indoor substation room
To process equipment
4/0 bare copper ground wire
MH
Detail 'A'
To buried ground plate
Ground to domestic water pipe at building entrance, using 2 heavy-duty connections spaced 12' apart. (See detail B)
Structrual columns (See detail E)
PARTIAL PLAN of INTERIOR GROUNDING SYSTEM
Cross connector ground clamps
Type DR ground clamps
Connections to equipment of steel structure brazed to ground bus installation
500 MCM bare ground cable connecting ground rod
Fence line
GROUNDING LAYOUT for OUTSIDE SUBSTATION
Splices and taps connected with two bolts spaced 12" apart. Wires between connectors brazed solidly
4/0 bare copper tap to ground plate and ground wire.
Detail A
Heavy duty ground fittings
Main from street
Sprinkler
Domestic water
4/0 bare copper continuous
Detail B
WATER METER PIT
showing electrical bond around water meters.
500 MCM bare ground cable
Type DR ground clamp
Copper weld ground rod 5/8"x10'
Detail C
Finished floor
Ground wire splice
Detail D
Structural column
bolts and nuts
U-bolts
4/0 bare ground
Flat copper plate
1/0 ground for lighting transf.
PLAN
Flat copper plate
1/0 ground for lightg transf.
Copper plate brazed to inside of col. flanges
U-bolts
Equip ground
Buried ground
Detail E
ELEVATION

GROUNDING PROVISIONS for both interior and exterior electrical installations are extensive, with cold-water piping, buried electrodes, ground rods, building columns and bare copper cable gridwork combined in a safety system of unusual scope. Variety of brazed junction details, bolts, clamps and connection arrangements are utilized, a few of which are indicated by this sketch. The same type metal was used throughout to minimize galvanic action.



MERCURY VAPOR and incandescent lamps are mounted in pairs to illuminate production area, these Hibay units being suspended by means of yokes, conduit hangers and J-bolts secured to purlin-spanning struts. A variety of floodlights are used as indicated on roofs, walls and fence lines, while 2-lamp recessed fluorescent units equipped with eggcrate-louvered bottom panel are installed in office areas as shown above.

elevated CTs and metering PTs are carried in conduit first underground then upwards to the overhead mounting position.

Mercury-Incandescent Combination

Plant illumination in the order of 35 fc is provided by Holophane prismatic glass Hibay reflectors in spun-aluminum covers which are suspended in pairs at truss height on a 19- by 25-ft spacing pattern. Alternately containing 400-watt mercury-vapor and 750-watt incandescent lamps, reflectors are suspended by means of yokes, adapters and conduit hangers. A single-lamp ballast for each mercury unit is mounted directly above each pair of reflectors, while conduit hangers are supported by eyecaps and J-bolts that pierce purlin-spanning cross braces. Flexible connections between deflectors and yokes, yokes and conduit hangers, and hangers and overhead branch condulets facilitate detachment of units for cleaning, repair or rotation.

In addition to this general plant-illumination pattern, RLM dome reflectors, lamped with 300-watt incandescent lamps, are centered between trusses over each day. These units, attached directly to outlet boxes by short nipples, are provided for night-lighting purposes. This same type of incandescent pendent hood is also used in such functional areas as switchgear, locker and boiler rooms.

To floodlight exterior parking lots, truck-loading platforms, fence lines, substation pads and surrounding grounds in general, a variety of weatherproof luminares are used. As indicated by an accompanying sketch, some of these exterior lights are mounted on flat or inclined roof sections by means of vertical pipe masts equipped with swivelling yokes or with brackets and service-entrance caps. Other units are mounted against vertical wall sections by means of graduated aiming arms, condulets and wall-piercing conduit stubs.

Control of lighting is by means of either (1) standard-width panels having double rows of non-automatic circuit breakers, with neutral terminal strips located above, or by (2) narrow single-row switching panels, neutrally-bussed both top and bottom, with lighting circuits positioned at the top and receptacle circuits placed below, and with separate lockable doors covering these two sections. All panels are dead-front units, flush-mounted in office areas and surface-mounted elsewhere. Narrow panels are mounted in the plant proper, placed between flanges of 16-in. structural columns.

Lighting panels are variously 4-wire 3-phase, and 3-wire single-phase, power for these units being provided locally through either 480/208/120-volt 3-phase or by 480/240/120-volt single-phase dry-type transformers.

Control of night lighting in the plant, as well as protective lighting outside, is by means of astronomical time clocks.

The plant was wired jointly by Beach Electric, of East Orange, and Emerson-Garden, of Elizabeth, New Jersey.

Chicago's State Street has

World's Brightest Street Lighting

New 4-luminaire standards with power-groove fluorescents on radio controlled switching relights famous shopping area to illumination values unprecedented for street lighting.

by Mort. J. Glenner, Supt., and Joseph Chaput, Engineer,
Commercial Lighting Company, Chicago

OVER three years of study and research went into the planning to provide Chicago's State Street with one of the most powerful and advanced street lighting systems ever devised. The unique system consists of 70 tree-like standards, each holding four, 7-ft, 6-lamp power groove fluorescent luminaires, installed over a seven block stretch in the heart of Chicago's "loop" (business district). In addition it is the first major street lighting system to utilize radio control.

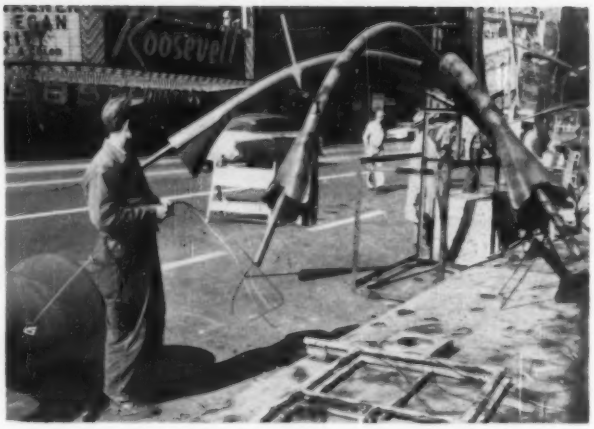
This history-making installation is an excellent example of what is needed and what can be done to relight downtown U.S.A. The new installation is not only functional, but artistically attractive. The job reflects bold and imaginative use of modern street lighting equipment that reportedly is years in advance of anything previously attempted.

Final installation of the lighting modernization job took place on November 10. And on November 13, the new lights were turned on for the first time as the highlight of an elaborate celebration sponsored by the State Street Stores.

The 70 tree-like standards used for the relighting project were fabricated by the Union Metal Co., of Canton, Ohio, the company which in 1926 built the original poles.

Designed by Robert O. Burton, a native Chicagoan, the new standards have one tree-like central pole from which branch four graceful arms that hold the power-groove fluorescent luminaries. The first arm is mounted 24 ft above and parallel to the sidewalk. The two

WORK CENTER on State Street was in front of Marshall Field's, where all preliminary work prior to installation of poles took place. Notice arm for sidewalk luminaire being mounted to the pole. After all final adjustments were made the arm was firmly welded to the pole.



PREWIRING POLES and mounting radio antennas (arrow) are just two of many jobs accomplished at ground level before final setting of standards.

side arms arch at 34 ft, while the center arm is mounted at 36 ft. All three top units fan out over the street at 20 degree angles to the horizontal—to provide an even distribution of light in all directions. The top center fixture is controlled to serve as a dusk-to-dawn or all-night light.

The standards are approximately 36 ft high and are made of ⅜-in. cold rolled steel. They taper from an 8-in. diameter at the top, to a 12-in. diameter at the bottom. At sidewalk level the base flares to a 34-in. diameter. Ten poles are installed on every block (five on each side of the street) over the seven block stretch. In most cases the 72- to 92-ft spacing of the old units was maintained. Each of the steel poles, minus fixtures, weighs approximately 2600 lbs.

Air Conditioned Luminaires

The complete fluorescent street lighting system has a total of 280 fixtures. Four 7-ft fixtures are mounted on every pole (total of 70 poles) with each fixture containing six 72-in. power-groove fluorescent lamps that operate at 208 volts. The power-groove lamps and the specially designed luminaires were manufactured and supplied by the General Electric Company. A total of 15,624,000 lumens of light, or 223,200 lumens per pole, is produced by the new system. Instead of conventional glass enclosures, each fixture is fitted with a heat-resistant translucent acrylic plastic lens that is slightly clouded to mask the fluorescent tubes during the daytime. The plastic enclosures were used in place of glass without greatly decreasing lamp efficiency.

Because temperature changes affect the efficiency of fluorescent lamps, the fixtures designed for the job are the first to employ a completely sealed cooling system. The "air conditioning" equipment consists of a centrifugal blower driven by a unit bearing motor, and a recirculating fan driven by the same motor. Thermostatic control is provided to maintain air temperature inside the luminaires at a level for optimum light output of the power-groove lamps. The entire air path through the fixture is sealed and gasketed to prevent entrance of dirt and insects. In addition, the luminaire features a cold-weather ballast to insure lamp starting in temperatures down to 20 degrees below zero.

Built-in Receptacles

In order to provide for illuminated decorations temporarily installed over the street during various festive occasions such as Christmas, each of the 70 poles has a built-in 6000-watt weatherproof receptacle. The 41-wire, 120/208-volt, 3-phase receptacle is mounted near the top of each standard and its switching is either radio controlled or operated manually from the lighting system's master control center.

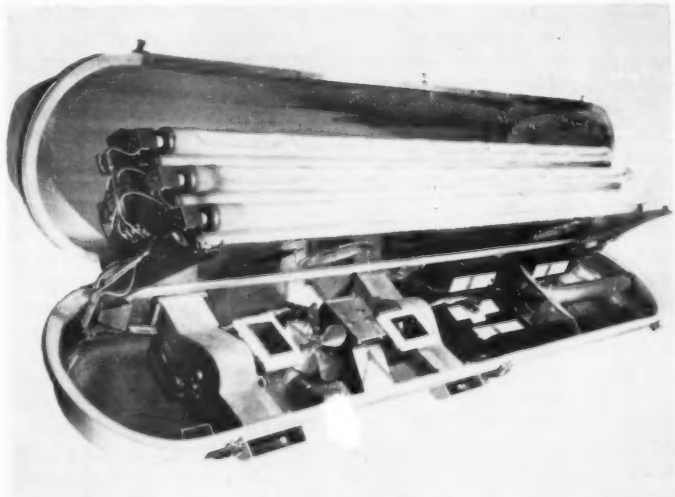
Since the existing system's feeders were undersize and not suitable for reuse, a completely new instal-

POLES were set after bases were readied and as much work as possible was accomplished at ground level. The poles were raised in place during early morning hours or on Sundays when traffic was less conjested.

PLATFORM HOIST, hydraulically operated and mounted to truck body, simplified installation of luminaires and lamps. The unit, which extends to 60 ft, was also used to mount planter bowls and paint the poles. To install the luminaires over the sidewalk a 4-ft by 5-ft rolling type scaffold was used.

lation of conduit and circuiting had to be installed. This was carried on in existing subway areas beneath the sidewalk. However, about 90% of this space had been taken over by the stores bordering the sidewalk. This caused many problems, including running new conduits in finished store areas and drilling through thick foundation walls. But a major problem existed at street intersections and alleyways. The cost of breaking into the street at intersections and alleyways to provide for connecting feeders was excessive, and store owners and city officials were reluctant to do anything that would disrupt the flow of traffic on this, one of the world's busiest thoroughfares.

Commonwealth Edison's engineers, headed by John Weber, solved the problem by supplying each block with four service location points, fed directly from the utility's network loop system. This means there



INSIDE VIEW of new 7-ft, 6-lamp power groove fluorescent luminaire details "air conditioning system" (note fan). Air enters left vent and is forced by centrifugal blower into inside of reflector-heat exchanger and out right vent. Fan mounted on same motor shaft recirculates captive air over lamps and ballasts, helps maintain optimum temperature.

PORTABLE ELECTRIC DRILLS were used in basement areas to drill through foundation walls up to 36 in. thick in order to provide for circuiting between poles. About 90% of the area had been taken over by the various stores and made into finished areas which made circuiting even more difficult.

TYPICAL SERVICE LOCATION is one of 28 supplied by the Commonwealth Edison Company from their network loop system. Main breaker mounted next to service box controls a group of three poles. Photo was taken in one of the few unfinished subway areas located beneath the sidewalk.

are two services on each side of every block, or 28 service location points throughout the seven block stretch. In each case, and the pattern is followed throughout, one service provides current for a group of three poles and the second feeds a group of two poles on each side of every street. This arrangement also lessens the danger of all lights going out at once during any partial power breakdown. The 120/208-volt, 4-wire, wye, 3-phase supply is not metered, but billed yearly at a pre-established rate.

Radio Control

The lighting system was planned and installed as a means of tying the shopping district together; therefore, controlling the lights to go off and on simultaneously was of the utmost importance. It was learned that time clocks mounted at each of the 28 service locations would not exactly synchronize these operations. And, a "wired" control system between the 28 service points governed by an automatic control center could not be installed because of the problems previously mentioned concerning breaking up street intersections, etc.

After due consideration and investigation, a "wireless" or radio controlled system was designed and installed to provide all switching operations. Thus, the spectacular lighting system, besides ranking as the world's brightest street lighting installation, is also the first major lighting program to use radio control switching.

Construction-wise, installation of the "wireless" system was relatively simple and less expensive than a "wired" system, although yearly maintenance cost will run somewhat greater. Each group of two poles and three poles (depending on service arrangements) has one control post that is fitted with an antenna near its top and a radio receiver and contactor switch in its base. The radio frequency waves transmitted from the master control station are picked up by these receiving sets located in the bases of the 28 master control poles. Here, after the radio impulse is decoded and amplified, it actuates a momentary contact switch which in turn energizes the switching device of each pole in the master control pole's group.

The centrally located radio control master station (installed in the Carson Pirie Scott & Company department store) is governed by an astronomical time switch and acts as the brain of the system. The time clock actuates an electrical contact that causes the transmitter to broadcast various tone waves which perform the following functions: (a) One signal will cause all street lights to be turned on at dusk. (b) At midnight a second signal will turn off two fixtures over the street and one over the sidewalk, leaving the top center fixture burning at each pole until dawn. (c) At dawn a third signal will turn off the remaining fixture at each pole. In addition to these three signals, a fourth signal (d) controls the festoon lighting receptacles separately from the other operations. All the timing of these sequence operations will be provided automatically by pre-arranged settings on the astronomical time clock. If desired, the automatic control can be by-passed, and all switching functions selected manually at the control transmitter.

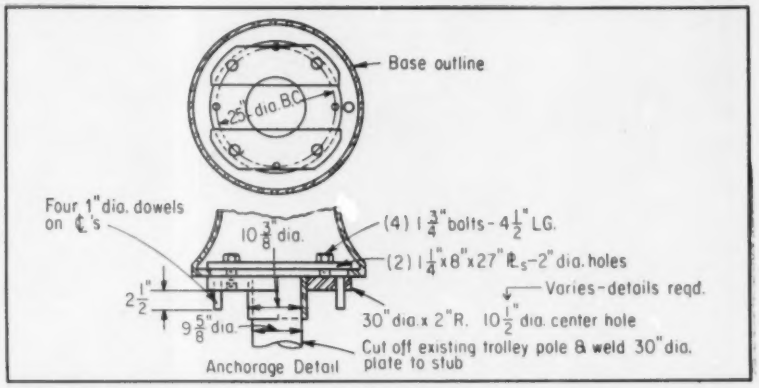
Automatically controlled heating units are installed in the base of each control post to maintain correct operating temperatures for the radio receivers so that they will function properly in cold weather and when the bases are covered with ice and snow.

Installation Problems

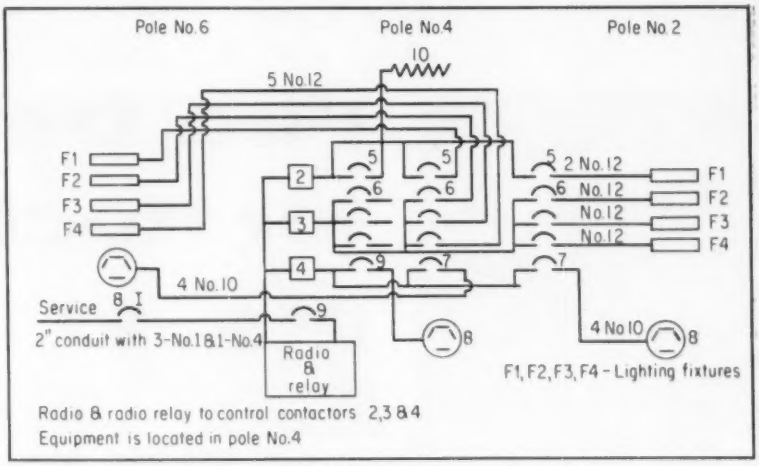
There were a number of imposing installation problems that had to be solved by the Commercial Light Company, project contractors. One of these was completing the job in a short period of time without greatly hampering State Street's constant flow of vehicle and pedestrian traffic. Briefly, the installation pattern went like this. Five poles were transported from the freight yard, one-at-a-time, to a central work center located on the street, directly in front of the Marshall Field and Company store. Here, the standards were readied for installation. The arm supporting the luminaire over the sidewalk was welded-on, antennas were installed in the control poles, weatherproof receptacles were attached, and each standard was pre-wired. After all this preliminary work was completed, (as much work as possible

was accomplished at ground level) on each of the group of five poles, they were raised in place the following morning between the hours of 1 a.m. and 5 a.m. This process was repeated until all 70 standards were installed, then the operation switched to the installation of luminaires and lamps, the setting of planter bowls, and finally the painting of each pole.

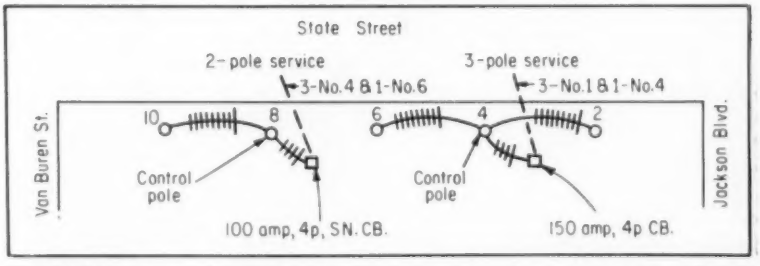
In addition to standard preparation, installation of luminaries and lamps, planter bowl setting, and painting, other daytime work simultaneously carried on included the following: (1) New conduits for the system's circuiting was run in existing subway areas beneath the sidewalk. Since about 90% of this area has been taken over by the various stores bordering the sidewalk, the going was slow and tedious. Store owners insisted that conduit runs installed in these finished subway areas be concealed, which meant that conduits had to be run through narrow drop ceilings and behind walls. In many cases 36-in. foundation walls between stores had to be drilled in order to provide circuiting between the control standards and the other one or two poles in its group. (2) Also, because the new standards utilized the same location as the old poles, the existing foundations were inspected, prepared and adapted to receive the new heavier type units. In all cases the existing 9-in. diameter trolley poles that supported the old standards were cut off 2 ins. above the sidewalk level leaving approximately 7 feet of each pole remaining below the ground. It was found that nearly one half of all of the 70 foundations would have to be reinforced. This was accomplished by fitting a 6-ft length of 7½-in. diameter oil well casing inside the existing 7-ft lengths of 9-in. diameter trolley poles. Four 3-in. slots were then cut in the 2-in. section of trolley pole protruding above the foundation. Flanges on the 7½-in. diameter oil well casings were then welded into these slots to make the two poles one. Next, 30-in. diameter, 2-in. thick steel plates tapped to receive four 1¾-in. steel bolts which will hold the standards in place were welded to each 2-in. stub. To further stabilize each standard the 30 diameter plates are equipped with four, 1-in. diameter dowels that extend 2½ ins. into the concrete foundation. (See anchorage detail sketch above.)


Base outline
25' dia. B.C.
Four 1" dia. dowels on ℄'s
10 3/8" dia.
(4) 1 3/4" bolts - 4 1/2" LG.
(2) 1 1/4" x 8" x 27" ℄'s - 2" dia. holes
Varies - details reqd.
2 1/2"
9 5/8" dia.
30" dia. x 2" R.
10 1/2" dia. center hole
Cut off existing trolley pole & weld 30" dia. plate to stub
Anchorage Detail

ANCHORAGE DETAIL shows how existing foundations were rebuilt to support new standards. About 50% of the foundations had to be reinforced by fitting a 6-ft length of 7½-in. diameter oil well casing inside the existing 7-ft lengths of 9-in. diameter trolley poles that remained below ground level.

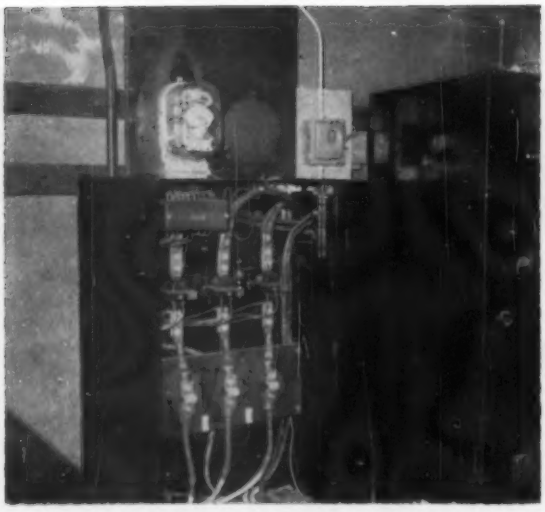


TYPICAL 3-POLE WIRING DIAGRAM shows location of (1) 150-amp, 4-p, main breaker; (2) 30-amp, 3-p, contactor—dusk to dawn; (3) 60-amp, 3-p, contactor—dusk to midnight; (4) 60-amp, 4-p, contactor festoon lighting; (5) 15-amp, 2-p, CB fixture No. 1; (6) 15-amp, 3-p, CB fixture No. 2, 3 and 4; (7) 30-amp, 4-p, SN, CB festoon lighting outlet; (8) 20-amp, 4-p, SN receptacle; (9) 15-amp, 2-p, sn CB radio control unit; (10) 200-watt heating element.

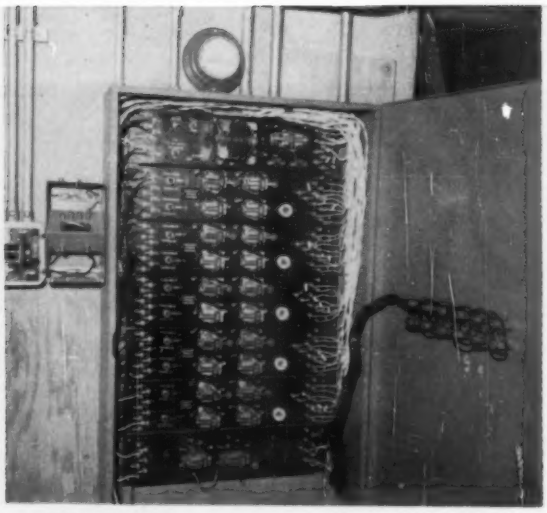


SCHEMATIC of one side of State Street between Van Buren and Jackson Streets lists typical arrangement of 2- and 3-pole services and their control poles.

The new street lighting installation represents an expenditure of nearly a half million dollars which means an average cost of $7,000 for each of the 70 standards. The overall system is owned and operated (as was the 32-year-old incandescent system it replaces) by the State Street Lighting Association (a group of business men who own or operate business establishments bordering State Street). The city of Chicago pays part of the cost with funds that it would have to spend for a normal street relighting program and its maintenance.



FUSED DISCONNECT SWITCH provides 3-wire, 20-amp, No. 12 circuit to fire detection system transformer. Supply connections are made in current transformer box ahead of main switch.



CONTROL PANEL is equipped for ten zones. Top section is master control and power supply. Five intermediate sections are each 2-zone control units. Bottom section is "city" control, which operates a nearby municipal F.A. box.

ALARM HORNS are enclosed, wall mounted, give distinctive, unmistakable warning. Fourteen alarm horns are used in the system, operate simultaneously on detector signal from any zone.

Fire Detection for Rochester's P.S. 17

Ten-zone, 300-point automatic fire detection system is installed in Rochester, N. Y., Public School No. 17 under direction of Board of Education Architect Francis A. Scherer by Conlang Electric Co.

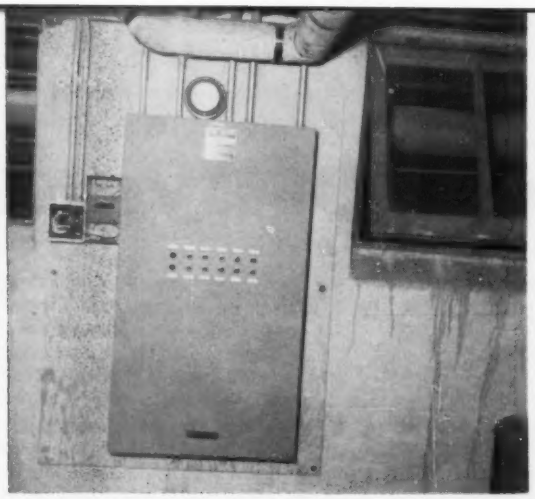
By W. T. Stuart

INSTALLATION of a complete fire detection system in an existing Rochester, N. Y. public school is a significant development in the current progress of this modern, new alarm facility. The system comprising a 10-zone control with 300 automatic fire detectors throughout old Public School No. 17, is typical of potential applications in both new and existing school buildings throughout the country.

The P. S. 17 job was planned and directed by Francis A. Scherer, architect for the Rochester, N. Y. Board of Education and installed by Conlang Electric Co., electrical contractors. The contract totaled approximately $11,500.

Operation of the system, which is fully automatic, centers in a master control panel located in a custodian's room in the school basement. The steel enclosed panel houses the power supply features and the various relay networks which operate the system and supervise its operating condition. On the cover of the control panel, a group of indicator lights show the condition of the system and, in the case of a fire, indicate the specific zone from which the alarm signal originated.

The signal initiating devices or detectors, totaling 300, are located through the building. Two types are used, depending upon the area to be covered. Of the total, 230 are fixed temperature types, covering a 20-ft by 20-ft area, which respond to any increase in temperature over a tnreshold value, typically 140°F. The remainder are combination types, covering 50 ft by 50 ft, and responding not only to a threshold temperature but also to any sudden rise in temperature.



INDICATOR LIGHTS are located in panel door. Trouble and alarm lights at left are normally extinguished, each of ten zone lights are normally lit. Operation of any detector or manual station causes alarm signal to light—associated zone indicator to go out.

CEILING SURFACE-mounted combination detector covers 50- by 50-ft area and responds to high temperature or rate-of-temperature rise. Detectors are wired with No. 16 twisted pair ivory plastic insulated conductors open on cleats 8 ft or more above floor, in EMT where wiring is under 8 ft.

Detectors are automatic and self-restoring.

Operation of a detector by heat will (1) indicate the zone on the master control panel, (2) light the alarm signal, (3) sound the evacuation horns, and (4) initiate a conventional coded fire alarm signal on the municipal fire alarm system.

In addition to the automatic detectors, 12 manual fire alarm stations are provided in the detector circuits. Operation of the manual stations has the same effect as automatic operation of the detectors.

The alarm consists of 14 enclosed horns located through the building. In addition, a trouble buzzer at the panel and a horn in the custodian's office sound in the event that the electrical supervisory circuits indicate trouble on the system. A cut-off switch is provided to interrupt the circuit to the municipal fire alarm box for tests and drills. A trouble bell rings continuously until the normal connection is restored.

The system is wired with No. 16 twisted pair plastic insulated wire. Over 8 ft from the floor, conductors are run open on small wooden cleats. Within 8 ft from the floor, the wiring is run in EMT with conventional outlet boxes and fittings.

Power supply is tapped off ahead of the main switch at the service. A 20-amp circuit serves the system transformer which reduces voltage to a rectifier providing 20 volts dc. Emergency supply, automatically connected on power failure, is provided by two sets of four 6-volt dry cell batteries.

FIXED TEMPERATURE detector covers 20- by 20-ft area, responds to high temperature. Unit shown before completion illustrates typical wiring in outlet box with EMT. About 30 detectors are wired on one circuit or zone. All detectors are self-restoring. A total of 300 are used in the system.

MANUAL ALARM stations, 12 in all, are non-code, single-action and wired into detector circuits. Operation of manual box has same system effect as automatic detector, indicating the zone, lighting the alarm signal, sounding the audible alarm, and initiating the coded alarm signal on the municipal system.

OUTSIDE CITY fire alarm box is wired to "city" panel of main control and triggered by either the automatic detectors or manual stations.

TEST CONTROL switch opens "city" connection for tests and fire drills. Trouble bell rings continuously until normal connection is restored.

System changes for

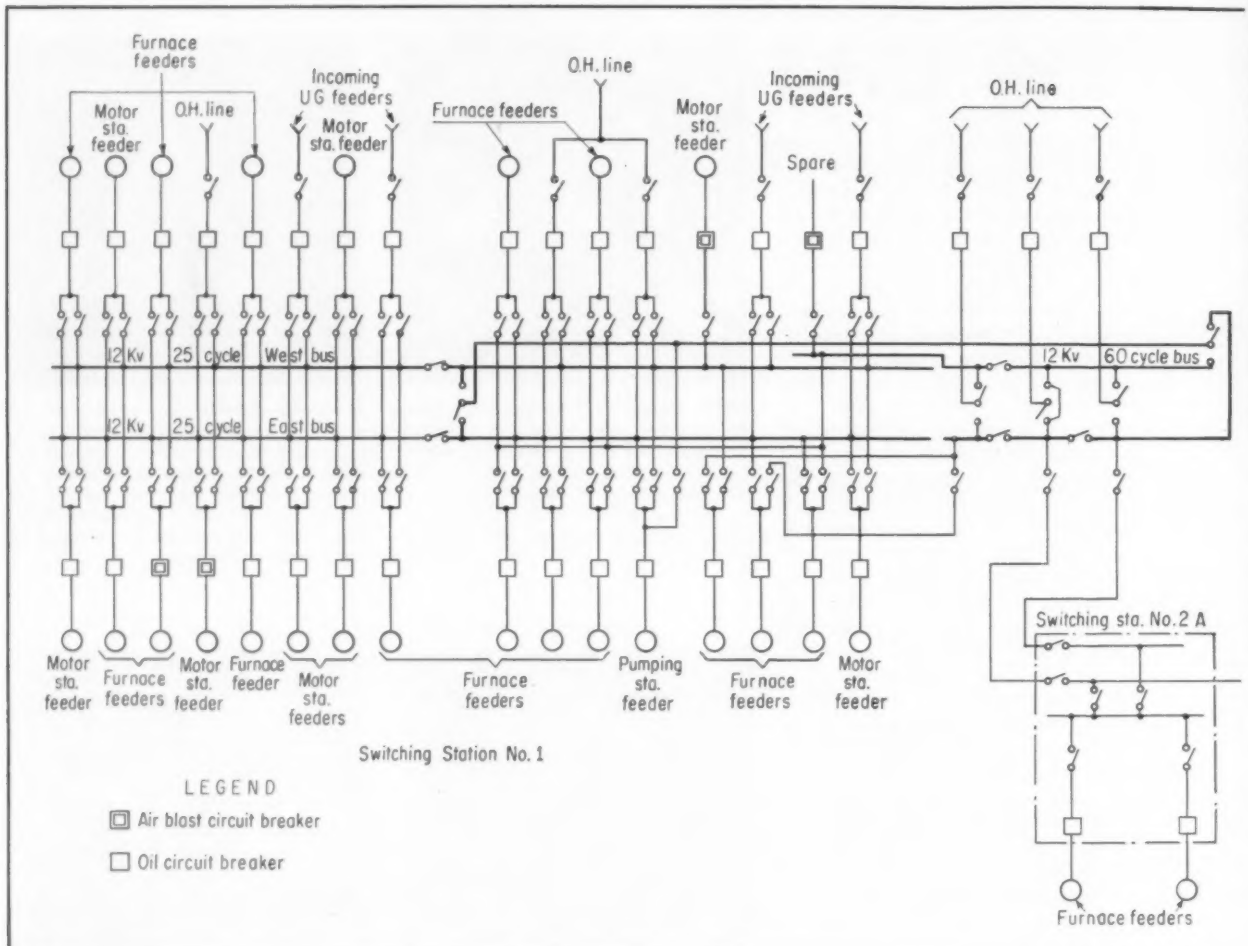
25- to 60-Cycle

involved higher voltage, higher interrupting capacity in switchgear, power factor improvement and central motor control.

By Theodore A. Leeds

Design Engineer
Electro Metallurgical Co.
Division of Union Carbide Corp.
Niagara Falls, N. Y.

FOR many years, power has been delivered to our Niagara Falls plant at 12 kv by means of a multiplicity of underground and overhead feeders serving us directly from Niagara Mohawk Power's Harper substation. This situation meant that practically no limitations were placed upon our power requirements which, until recent years, amounted to about 10,000 kw for power and lighting, plus about 165,000 kw for our submerged-arc furnace load. Virtually all of this power was supplied at 25 cycles, the frequency at which power had



PRIOR TO CONVERSION, power requirements were provided through multiplicity of both overhead and underground feeders, predominantly at 25 cycles and 12 kilovolts. Since this voltage-frequency combination was ideal for direct operation of electric furnaces, there was little need for transformer equipment except to handle minor lighting and motor loads. Also, since motor and lighting loads were relatively small, expansion of all electrical facilities was generally at the 25-cycle frequency. Substation shown at right of diagram was installed in 1951 in anticipation of major increases in 60-cycle

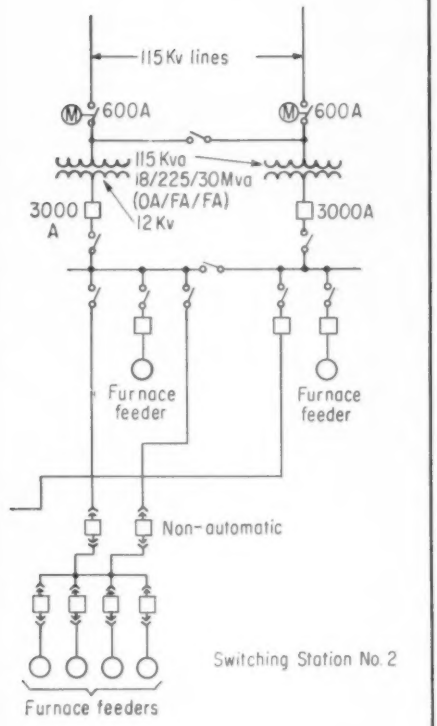
Frequency Conversion

been initially generated and distributed throughout the Niagara area. Due to related low reactance, this 25-cycle power was particularly attractive for furnace loads. Consequently, all of our furnaces were designed for operation at this frequency, even after 60-cycle power became available in the district.

Because of the availability and reliability of our 25-cycle supply, and also because our combined motor and lighting loads were relatively minor, even our motor and lighting loads were expanded at the 25-cycle level. This was done in spite of lower costs and higher efficiencies of 60-cycle equipment.

Since power was delivered to furnace transformers directly at supply voltage, we had no need for any power transformer capacity for that purpose, although we did have a sizable installation of 12-kv switchgear related to general distribution. There were, of course, a number of load-center substations required for stepping voltage down to lower utilization levels for motors and illumination requirements.

In this generalized installation we found that our switching equipment provided considerable flexibility and was quite satisfactory from an operational standpoint. And, since we contemplated the continuance of sufficient 25-cycle power at reasonable rates, we could imagine no serious operating or economic justifications for changing over to 60-cycle operation.



power demands but, due to a concurrent lag in production, this station remained deactivated until 1956. Under conditions existing prior to that date the switching flexibility proved satisfactory.

Partial Switch Dictated by Load Growth

In 1951, the need arose for considerably more power. This could still be obtained at 25 cycles but, inasmuch as it would have to be steam-generated by old equipment, the utility rate would be quite high. So, since 60-cycle power was now available at about half the cost of additional 25-cycle power, and also since some of our furnaces could be adapted quite readily, we decided to purchase additional power at 60 cycles and 115 kv. To handle this new supply we installed a 60,000-kva substation consisting of two 30,000-kva transformer banks.

Shortly thereafter, when it became evident that the up-coming Niagara Power Development Program would greatly curtail the availability of 25-cycle current by diverting water used for its generation, it became apparent that another large portion (but by no means all) of our Niagara plant load would have to be converted to 60 cycles. Studies were promptly initiated for implementing this conversion but, with a concurrent (and temporary) decrease in production and overall power requirements, we not only suspended our expansion plans, but we de-energized our already-installed 60-cycle substation as well.

Utility Disaster Forces Conversion

This situation was abruptly altered on June 7, 1956, when a giant rockslide at Niagara Falls completely destroyed the Schoellkopf station, wiping away with it our source for about 50,000 kw of low-cost 25-cycle hydro power.

Complete conversion of our plant now became mandatory and, in reviewing our former plans, we discovered that many factors required re-evaluation while others had become nebulous.

One factor was perfectly clear, however, for we realized that we no longer could enjoy the advantage of having power delivered to us at furnace-utilization voltage. In the quantity we required, power would be delivered only at 115 kv. To obtain lower voltage levels, the power company would provide necessary step-down transformers, although premiums related to this proposal were sufficiently high to cause us to abandon this thought. As an alternative, we began an intensive study to estimate our future expansion potential, a maximum future load for our Niagara plant, the size of the required transformers, future power charges, and the like.

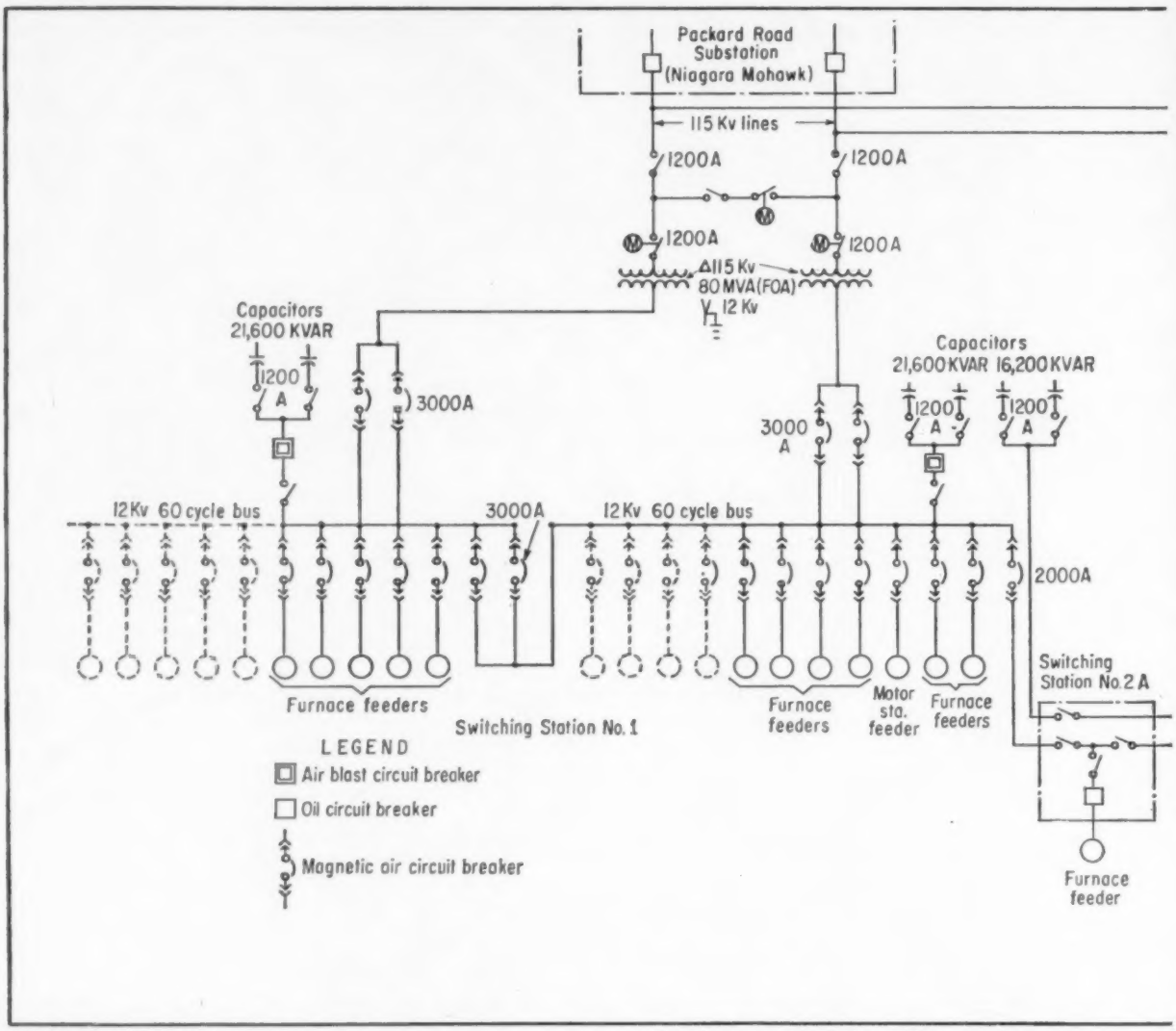
To meet our estimated requirements, we decided upon two 80,000-kva 3-phase transformers, and all subsequent planning was continued on the basis of this decision. Since we will be supplied by two 115-kv feeders and since the power company requires that the load be fairly evenly balanced under normal conditions, it was necessary to select an even number of transformers, which we did. We also re-energized our previously installed 60,000-kva 60-cycle substation. The two new substations, although some distance apart, are served by the same two overhead lines. And, since either line has sufficient capacity to carry the entire plant load, we be-

lieve that our future power supply is reasonably insured.

Our present 12-kv power switching facilities are indoors and consist of large cell-mounted oil circuit breakers. Their interrupting capacity is limited and is far below the requirements of the new 60-cycle system. This necessitates the installation of completely new 60-cycle switchgear. 750-mva metal-clad switchgear has been selected for this purpose. The two new 80,000-kva transformers cannot be paralleled on the 12-kv side, so this switchgear will be entirely adequate. We briefly considered parallel operation with 1,000-kva switchgear, but this was discarded for two reasons: first, the circuit breakers would not have adequate interrupting capacity, although we could have adopted one of several expedients to take care of this; and second, due to the close proximity of our substation to the power company substation, the transformer relays would have been extremely expensive and we could not justify the extra cost to obtain parallel operation.

The rated secondary current of each transformer is 3850 amps, which would indicate a transformer secondary breaker with a continuous rating of at least 4000 amps, and such breakers are not available. Although we do not like to use breakers in parallel, we were forced to consider using two 2,000-amp breakers (the highest available rating) with forced-air cooling to provide a rating of 2500 amps each. We felt that forced-air cooling was necessary to take care of any unequal division of current between the two breakers which would at times be operated near their rating, as well as to provide for some occasional overloading of the transformer.

Then it was suggested that we use 3,000-amp, 1,000-mva breakers in parallel for this purpose instead of the forced air-cooled 2,000-amp, 750-mva breakers. This seemed to us a very much better application



COMPLETE OPERATION with 60-cycle current became mandatory when giant rock-slide destroyed former source of 25-cycle hydro power. Load growth likewise dictated that primary voltage level be raised from 12- to 115-kv. New system involved installation of two new 80,000-kva substations plus reactivation of formerly-installed 60,000-kva station shown at right of diagram. Completely new 60-cycle switchgear was also necessary, using 3000-amp, 1,000-mva secondary breakers in parallel as indicated. Changes in the furnace feed system involved busbar modifications and forced ventilation

at very little extra cost, and it was no great problem to integrate the 1,000-mva breakers into the lineup of 750-mva switchgear.

While we were forced to accept parallel operation of breakers, we did gain one compensating advantage in that it is possible to maintain the transformer breakers one at a time while still carrying 75% load on the transformer.

The existing underground cable system consists of paper-insulated, lead-covered cables which do not require replacement. Some furnaces have as many as four 500 mcm three conductor cables in parallel. Terminations were no problem previously, since there was plenty of room for potheads and connections when each circuit was fed by a circuit breaker occupying a 15-ft by 25-ft bay. However, with the new switchgear we will have four circuit breakers in the same space formerly occupied by only one. It is, of course, impossible to locate four potheads for such a furnace in one switchgear unit. We have decided to splice this cable in the basement to rubber-insulated cable, and then terminate the rubber-insulated cable in the switchgear, eliminating the potheads completely.

We had quite a planning problem in developing a scheme for installing the new switchgear in the same space already occupied by the old 25-cycle switchgear without incurring an interruption to more than one furnace at a time. While we were able to develop such a scheme, the installation would be greatly simplified if a reduced level of operation with a number of furnaces out of service should exist during the construction period.

Changes to enable some of the furnaces to operate satisfactorily on 60 cycles are extensive. These involve chiefly forced ventilation and other modifications to the busbar system, and changes in the flexible connections which carry current from the bus to the electrodes. With the present secondary conductor systems, the operating power factors on 60 cycles would be so low that they would be prohibitive. Even after conversion, they will still be relatively low, and large banks of static capacitors will be installed to correct the plant power factor to 95% for billing purposes. These capacitors will be switched manually. Our type of operation is essentially 24 hours a day, seven days a week, and an automatic switching scheme is not indicated. We estimate that the savings in power costs will pay for the capacitor installation in about 2½ years.

Because new switchgear is so much smaller than the circuit breakers being replaced, there will be room indoors for the new capacitor banks. Since we have to contend with an industrial environment, an outdoor capacitor installation would have involved metal-clad housings at an appreciably higher cost.

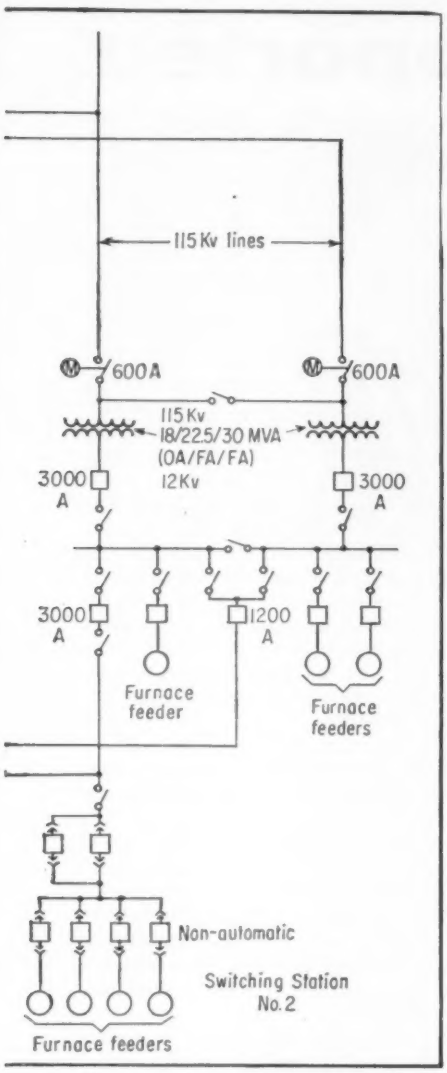
Control of the new 60-cycle substation will be centralized in the plant's main control room, along with remaining 25-cycle equipment. The original 60,000-kva, 60-cycle substation, which is again in service, will have its control moved to this same control room along with the controls for several furnaces in the same area, by means of a new supervisory control system. Since the new 60-cycle substation is quite near the control room, control can be direct.

It is of some interest to note that the new outdoor substation will be fed by overhead lines which will enter the plant along the same right-of-way now being utilized for the present overhead 25-cycle lines, some of which must remain in service until some of the load has been transferred to 60 cycles. As one of my colleagues has stated, "We are continuously bedeviled by the problem of having to install something in space already occupied by *another* piece of equipment which cannot be removed until the new equipment is installed in *its* place."

Magnetic Air Breakers Used At Furnaces

One last item is worthy of comment. Some electric furnaces require frequent disconnection from the power supply for operating reasons. While these are large furnaces, they are small in comparison to the capacity of the Niagara Mohawk system, and their switching does not cause any significant voltage fluctuation on the transmission lines. However, the old substation breakers were not suitable for this type of duty, and unit breakers were installed for the various furnace transformers. For many years indoor oil breakers were used for want of something better. Several years ago we requested quotations on a magnetic air breaker for this service. The operating duty stated was in excess of the ratings for any standard breaker available at that time insofar as the momentary current and frequency of operation were concerned, but two breakers were purchased and installed and have given outstanding service. Approximately 10,000 operations have been performed by each of these breakers to date.

Considering the many years involved in the development of the 25-cycle distribution system, as well as the varying conditions and requirements which applied during that period, we have had to make little compromise in the conversion program. With very few exceptions, the system is much as we would design it today, if we were to start from the beginning.



for same, also installation of large banks of static capacitors to maintain plant power factor above 95-per cent. Magnetic breakers were successfully used where furnaces demanded frequent disconnecting.

MANUFACTURING AREA of Pittsburgh Screw and Bolt Co. is lighted to intensities varying from 20 to 75 fc by fluorescent fixtures supported by steel channel raceway.

Prefabricated

Channel-Supported Lighting

in manufacturing plant provides specified illumination levels with maximum flexibility for future expansion.

THE lighting installation at the new consolidated plant of the Pittsburgh Screw and Bolt Co. at Mt. Pleasant, Pa., combined advance planning and modern installation techniques to produce efficient, flexible illumination with a minimum of jobsite fabrication or equipment modification.

Lighting specifications provide for intensities varying from 20 to 75 fc in specified work areas. This was accomplished using 2800 8-ft slimline fluorescent fixtures arranged in parallel rows. These fixtures were hung on continuous 14-gauge Kindorf steel channel support which served also as a raceway for fixture wiring, permitting precise row-spacing independent of the building structure.

Rows were spaced on 13-ft, 4-in. centers in areas requiring 40 fc or less. For 20 fc, each row has one fixture per 20-ft bay; for 40 fc, two fixtures. In areas requiring 75 fc, rows were spaced approximately 7 ft apart, with two fixtures per bay.

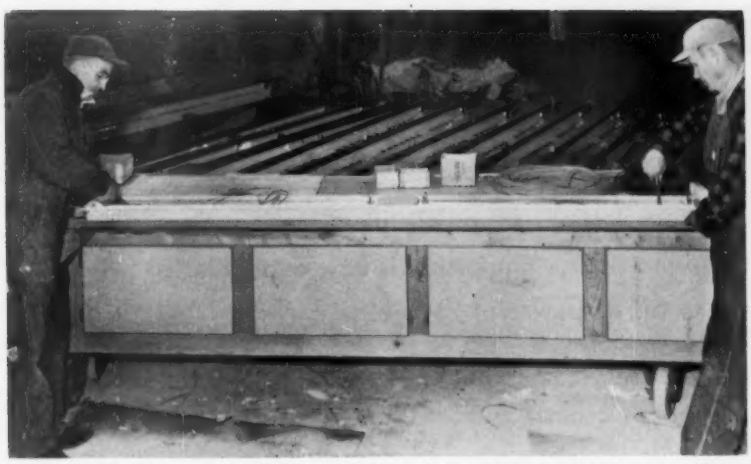
The generous interspace between fixtures was provided to permit the owner to change the lighting pattern or to increase the intensity in any area by simply adding fixtures to the existing rows or by moving the rows closer together. The power supply was 3-phase, 4-wire, 480/277 volts; the lighting required 315 separate circuits controlled from 13 panelboards.

Every step of the wiring procedure was planned in advance by Hale Electric Co., electrical contractors of Pittsburgh, including such details as arranging palletized shipment to jobsite of disassembled lighting fixtures and agreement with the channel manufacturer to ship the steel channel and cover strip pre-cut to beam span length and punched to match fixture knockout spacings.

Throughout the plant, fixture runs were laid out to cross the supporting beam structure at a 90-degree angle, with a 20-ft span between beams. This permitted the use of 20-ft channel segments with

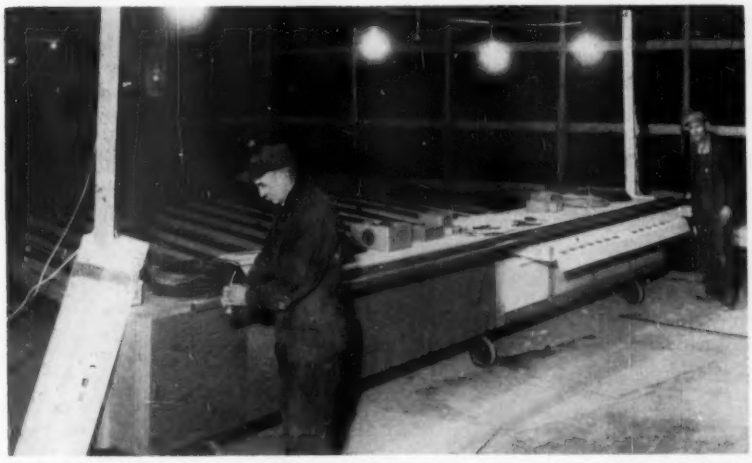
CENTER SUPPORT for fixtures consists of steel rod suspended from small channel welded across two adjacent purlins.

CIRCUIT FEEDS were accomplished by mounting outlet box with extension to top side of raceway channel.

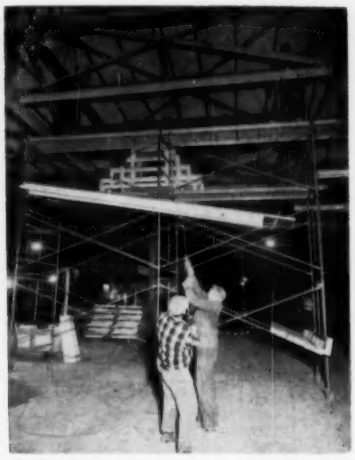


FIXTURE BODY is attached to channel by chase nipples and locknuts, utilizing channel knockouts. (Portable bench holds supplies in lower compartments, always accessible at the point of assembly.)

CHANNEL is turned over; fixture wiring is installed. (Palletized fixtures are visible in background.)



CENTER HANGER, closure strip, and chase nipple at end for wiring into boxes are installed; fixture is assembled and marked. (This assembly contains only a single fixture.)



ASSEMBLY is hoisted to ceiling for final installation and splicing. (This photo illustrates a 2-fixture assembly.)

one intermediate hanger rod support.

Planning the operation on the basis of these 20-ft units, Hale designed and constructed two standard assembly benches, each of which could accommodate two 2-man wiring teams (one on each side of the bench). These benches were of plywood and contained bins for the storage of wire and small wiring accessories. They were mounted on casters for mobility and, like the palletized fixtures, were easily moved from location to location as installation progressed.

Actual assembly of the 20-ft lighting units was also systematized. First, the channel was turned slot-side down and the wiring trough of the fixture securely attached to the channel through the knockouts provided, using a chase nipple-locknut combination for fastening. A wrap-around hanger was slipped in the channel to accommodate the intermediate rod support. The entire assembly was then turned slot-up and the wires simply laid into the channel. Wires were spliced and drawn into the fixture trough through the chase nipples. A snap-in closure strip (and end cap where required) completed the channel raceway except for a 2-in. space left at the end of the run. An outlet box was then mounted in this space and fastened securely to the slot side of the channel by means of a special device made to order by the channel manufacturer. Splices connecting the wires to those in the adjoining channel were later effected in this box and a flat cover applied.

After the fixture reflectors were added, the unit was assigned a number conforming with its position in the lighting plan and marked with a fluid pencil for identification purposes. Completed units were then hoisted into position and fastened to the supporting structure, and necessary splices were made. Intermediate hanger rod supports, suspended from a short length of channel fastened to the roof purlins, were then connected to the wrap-around hanger on the raceway channel.

Industrial Silicon DC Unit Substations

After two years of satisfactory testing, silicon rectifiers merit serious consideration for substation applications. Equipment is now available for primary voltages up to 14.4 kv for dc power at 250 volts.

By W. L. Overstreet,
Applications Engineer, Rectifier Section
Low Voltage Switchgear Dept., General Electric Co., Lynchburg, Va.

THE silicon rectifier with its high current-carrying capacity and very high conversion efficiency has effectively passed initial tests in industrial installations, for they have been in operation on such applications as dc motors in general shop service and dc cranes and electrochemical processes for about two years. Results have been gratifying, signifying that silicon rectifiers now merit serious consideration along with mercury arc equipment for industrial dc substation applications.

To determine whether the silicon rectifier or the mercury arc rectifier is better suited for any particular application requires a thorough economic and application engineering analysis of requirements, although the peculiarities of many individual applications make it impractical to lay down any hard and fast rules for the selection of either in this article. This article will be confined to the type of silicon rectifier equipment being recommended for general industrial loads today and some of the more important features required.

Recognition must also be given here that the silicon rectifier has proven itself in many other lower voltage and higher voltage applications, but this discussion will be

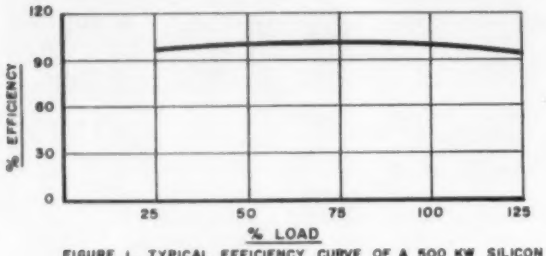


FIGURE 1, TYPICAL EFFICIENCY CURVE OF A 500 KW SILICON DC UNIT SUBSTITUTION

HIGH CONVERSION EFFICIENCY means lower rectifier losses, lower power costs and less heat dissipation (Fig. 1).

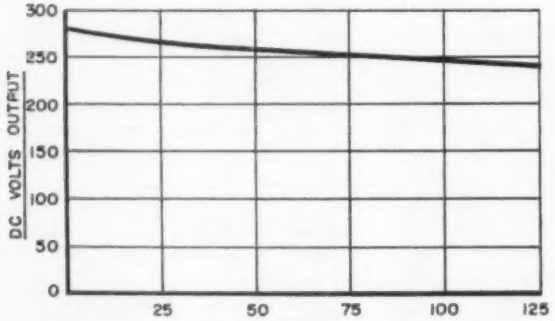


FIGURE 2, VOLTAGE REGULATION OF A TYPICAL UNREGULATED 500 KW SILICON DC UNIT SUBSTITUTION

VOLTAGE REGULATION from no-load to full-load is less than 8% in well coordinated silicon substation (Fig. 2).

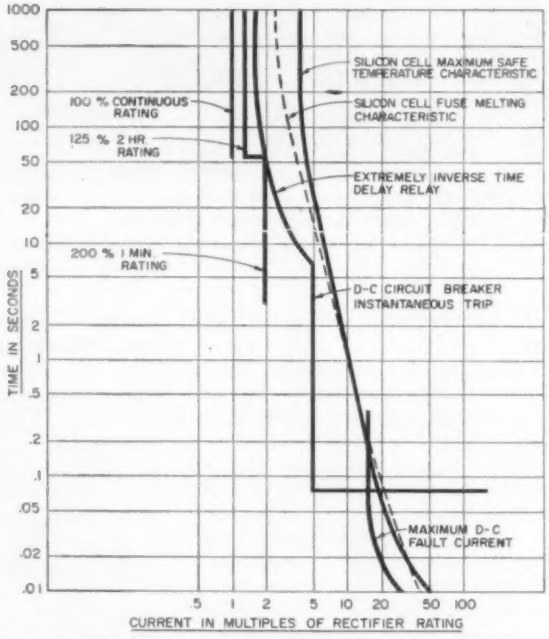


FIGURE 3 – OVERCURRENT PROTECTIVE COORDINATION CHARACTERISTICS

OVERCURRENT RELAY will clear sustained lower-level faults prior to cell or fuse damage, giving positive assurance that neither silicon cells nor their fuses can be damaged due to external short circuit. This figure shows the coordination between such protective features as breakers with instantaneous trip, extremely inverse time delay relay, etc. (Fig. 3).

confined to the 250-volt dc substation and blocks of power from 250 kw through 1500 kw, with primary ac voltages from 2300 volts to 14,400 volts.

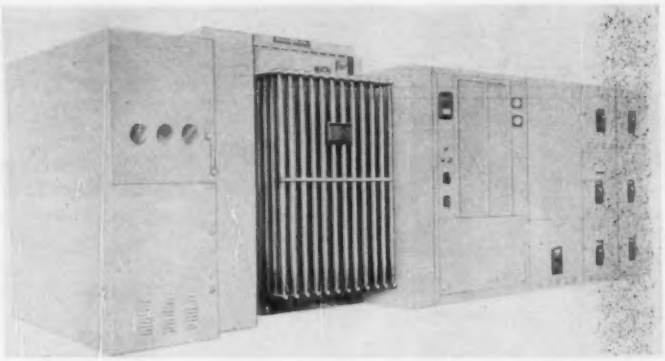
Conversion Efficiency

Probably one of the major reasons for the desirability of the silicon dc substation is indicated by Fig. 1. Very high conversion efficiency means lower losses in the rectifier with its corresponding lower power costs and lower heat dissipation into the rectifier room. This reduction of heat losses may indeed, in many cases, make the difference between needing air-conditioning equipment or not. In any event, conversion efficiency of 95% is a very attractive feature.

Prior to germanium and silicon, the most popular type of semiconductor (metallic) rectifier was selenium. Selenium rectifier equipments have features which usually made them unattractive for the dc substation type of equipment. Selenium rectifier equipment efficiency is usually about 10% lower than similar silicon equipment and the selenium rectifier element increases in forward resistance with operating time. This means, of course, that efficiency will drift downward with time and that all of the selenium elements will need replacement after five to eight years of operation. Not so with silicon. Silicon cells do not display this phenomenon known as "aging".

Voltage Regulation

Fig. 2 indicates the regulation curve of a typical unregulated silicon dc substation. The well designed and coordinated silicon substation will display a maximum of 8% voltage regulation from no load to full load. In a great many installations, this variation in dc voltage should be acceptable. However, the purchaser must also remember that the rectifier will reflect any ac line voltage fluctuation as approximately a proportional dc fluctuation. The purchaser's ac voltage fluctuations and the rectifier regulation should be studied carefully to ascertain whether some means of voltage control should be included in the dc substation package. An Inductrol regulator can be included in the dc substation setup to control dc voltage to within a narrow range of plus or minus 1%.



SILICON DC SUBSTATION equipment can be incorporated into aligned unit assembly, including all components necessary to bring ac voltage into station and connect dc loads directly to feeder switchgear (Fig. 4).

Continuity of Service

A high degree of dependability and continuity of service is usually of primary importance in a dc substation equipment. Failure or shutdown of the substation could subsequently shut down a sizable section of the user's industrial operation. It is, therefore, very important to include features of the design of the silicon dc substation to make it a "self-protected", practically foolproof unit not subject to shutdowns at inopportune moments.

This "self-protection" can easily be built into the rectifier simply by adding some very advisable features. Adequate silicon cell and cell fuse capacity to carry dc bolted short circuits for up to five cycles, adequate reactance built into the rectifier transformer, extremely inverse overcurrent relay, dc breaker with instantaneous trip, and counting type fuse monitor with visible and audible warnings should be included in the substation package and will give the necessary protection. Fig. 3 indicates coordination between protective features.

For the first five cycles of a bolted short circuit, the transformer reactance will limit the fault current to a value making it practical to utilize enough silicon cells and cell fuses to carry this short circuit for up to five cycles. In about 3½ cycles, the dc breaker will clear the fault. The extremely inverse-time-delay overcurrent relay will clear the sustained lower level faults prior to cell or fuse damage (see Fig. 3). This system obviously would give positive assurance that neither silicon cells nor their fuses can be damaged because of an external short circuit.

This silicon substation equipment should have a rating of 100% continuous, 125% two-hour, and 200% one-minute and, in fact, if the capacity mentioned in the preceding paragraph is available, these overload ratings are built into the rectifier section anyway.

The counting-type fuse monitor will count the series silicon cell string failures and will give visible and audible warnings on the first failure and shut the equipment down should a cell string in parallel with the first cell string fail. The above recommended overload ratings will allow continued full load operation of the substation even after one series cell string has failed. The remote possibility of a second silicon cell string failure before a shutdown is convenient to replace the first failed elements practically assures continuity of service. In view of the fact that for all practical purposes, rare replacement of a failed silicon element is the extent of the user's maintenance worries, the equipment should prove very attractive to maintenance supervisors.

This silicon dc substation equipment is now available for primary voltages up to 14,400 volts for dc power at 250 volts up to 1500 kilowatts. Fig. No. 4 indicates the matched and lined-up unit type of construction utilized. This unit line-up will include all of the components the purchaser requires to bring his ac voltage into the station and connect his dc loads on the other end. Therefore, the engineer who requires 250 kilowatts or more dc power would be wise to consider the silicon dc substation along with the mercury arc substation as a solution to his problem.

With Modernization Add

Electric Heat

How outmoded heating systems and inadequate wiring in existing homes are transformed to all-electric living with electric heat by Woolard Electric of Hartford City, Ind.

INCREASING SERVICE ENTRANCE from existing 60-amp, 220 volts, to 100-amp, 220 volts was the first step toward modernizing outdated residence to a modern all-electric dwelling that features a complete electric heating system.

WALL-TYPE heating panels were one of the two forms of electric heating employed in the conversion job. These units which were cut into walls, are completely recessed to present a neat appearance that does not distract from the room's interior decor.

OUTMODED heating systems and inadequate electrical facilities are transformed by an Indiana contractor for modern all-electric living, including electric heat at a reasonable cost and without undue inconvenience to the occupants—typical of the many current opportunities for electric modernization.

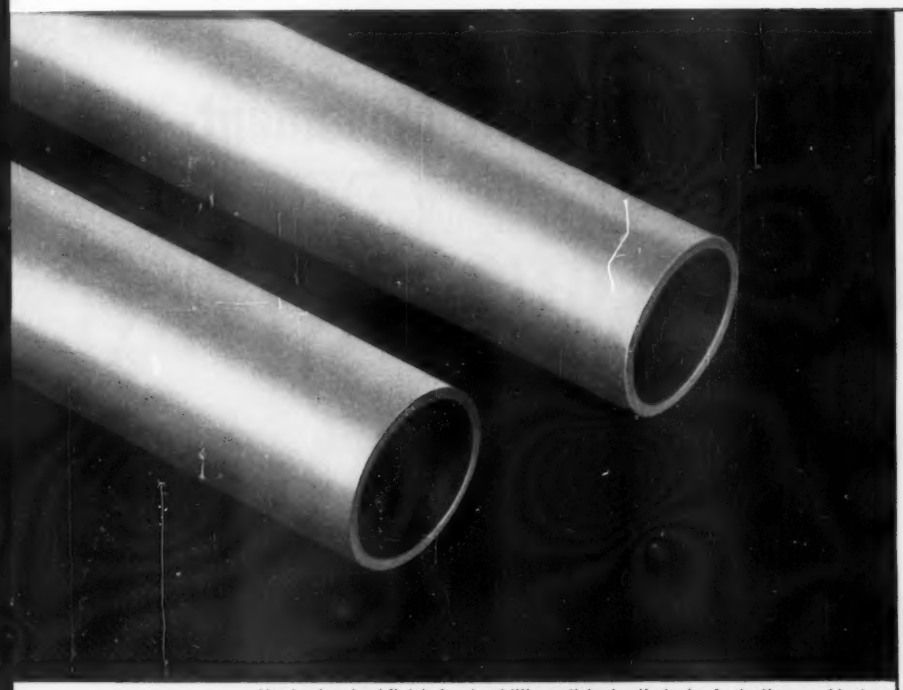
The first step necessary to convert to electric heat was to increase the service entrances. Woolard Electric and Electronics Company of Hartford City, Ind., electrical contractors, replaced the existing 60-amp, 220-volt service with a new 100-amp, 220-volt service that included the installation of a new fuse panel located on the rear porch to take care of the additional heating circuits. The next step called for the placing of the heating units, which were a combination of two forms of electric heat. In each of the three bedrooms, the kitchen, and hallways rectangular shaped wall-type panels were recessed into the walls, while in the living room the wooden baseboards under the windows were removed and baseboard heating units were installed in their place semi-flush with the walls. All heating circuits, which were carried by 12-2 BX, plus one bare copper ground wire, were run concealed by "fishing" the walls and running overhead through the attic crawl space to the new panel.

The last step but no doubt one of the most important phases of the job concerned the problem of insulation. This was accomplished easily by simply removing several shingles that insulate the home's exterior to permit the blowing-in of loose insulation between the side walls. Six inches of insulation also went into the ceiling and insulated batts were installed in the crawl space under the home to insulate the floor. Accurate heat control was further assured by individual line voltage room thermostats that govern a total of 7.5 kw of heating.

The complete job, including insulation, was installed by the Woolard Electric Company. The job was finished in less than 90 man hours and at a total cost to the owner of less than $1000. Estimated operating cost per year was $158. Actual operating cost last winter with 5900 degree days was $138.52.

WORKMAN is shown removing conventional molding to make way for installation of baseboard heating units. Circuits feed units through rear panel.

BASEBOARD UNITS are set in place and connected to heating circuits that are run concealed from new fuse panel located on the rear porch of the home.



Hard galvanized finish for durability; polished satin lustre for lasting good looks.

Even EMT can look good ...if it's CIRTUBE* EMT

TRUE, the first things you look for in EMT are: one, is it easy to work with—two, is it made to give lasting protection. CIRTUBE EMT, by the way, rates tops on both. But there's no reason why EMT can't *look* good as well!

That's where CIRTUBE EMT "shines," too. Reason for its pleasing polished satin lustre is the cyanide zinc plating process Circle uses (even though it costs a little more to apply than other methods).

The zinc bond is better, too—won't chip or flake off. That's because Circle employs elaborate cleaning processes to make sure that the steel is absolutely clean before plating.

Quality finish is only one of many reasons why CIRTUBE EMT has gained such wide acceptance in so short a time. Why not try it next time you order—you'll like it.

*Trade Mark

CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities

RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
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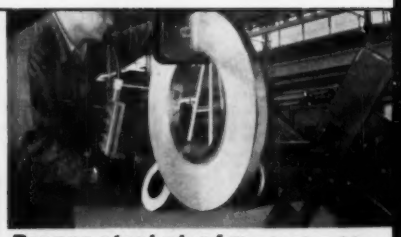


Proper steel plus! The best cold rolled steel plus the right handling give CIRTUBE EMT its natural bendability.

Easy fishing! A baked-on protective coating gives CIRTUBE EMT a built in lubrication for easier wire pulling.

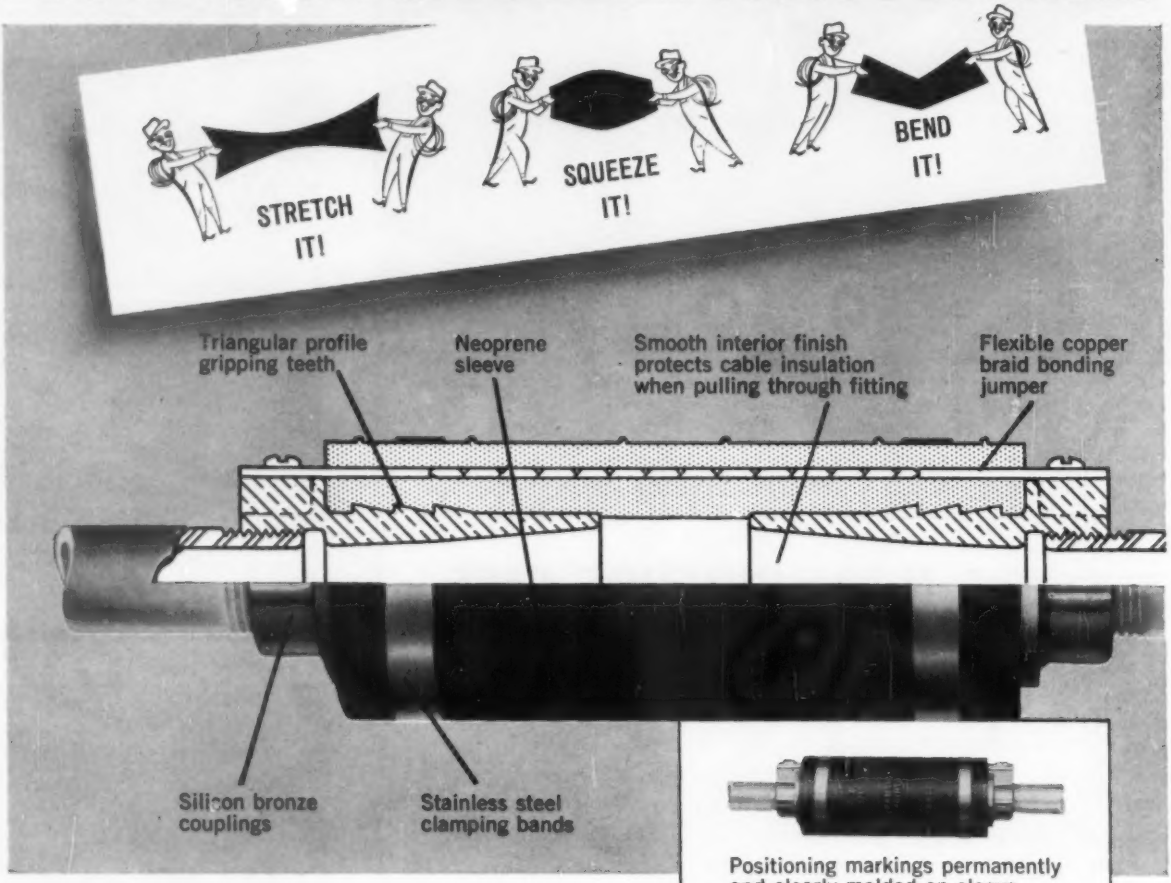
Split-free, bead-free! Induction welded CIRTUBE EMT, left, proves stronger than ordinary EMT, provides easier fishing.

Automated quality control! Automatic controls assure complete and continuing uniform quality of product.

Tight, easily handled bundles! Bright, orange tapes hold CIRTUBE EMT securely for easy handling on and off the job.

Fast, friendly service! Well-known Circle service through a nation-wide network of well stocked nearby warehouses.

For Positive Freedom of Conduit Movement—
THE ALL NEW O.Z. TYPE "DX" EXPANSION & DEFLECTION FITTING!*



Here's the newest addition to a long line of O.Z. expansion and deflection fittings — the O.Z. Type "DX"! Of completely new design and construction, it provides fitting features *never found before!*

The all-new Type "DX" is designed principally to compensate for expansion, contraction, and deflection in conduit across expansion joints in concrete, but it also may be used as a vibration damper.

For more information on this rugged, corrosion-proof, Weathertight fitting, call your local O.Z. distributor or write direct to the company.

Positioning markings permanently and clearly molded on sleeve assure proper placement of fitting in expansion joint

- **Compensates for expansion, contraction, deflection; may be used as a vibration damper.**
- **¾" expansion and contraction movement.**
- **30° angular deflection from the normal in any direction.**
- **Corrosion-proof!**
- **Weathertight!**

*Patent Pending

O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
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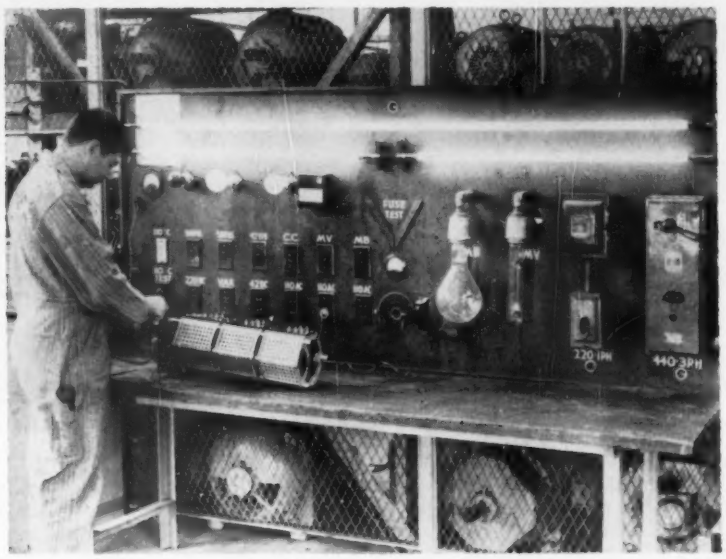
Practical Methods



REPLACEMENT of parts or units promptly, then thorough checking on shop-designed-and-constructed test board located in centralized electrical maintenance department, has resulted in faster, more efficient and more economical operations at Alabama tube plant.

Testboard Speeds Maintenance Work

MAINTENANCE

"If a part seems to be giving trouble, don't check it—yank it". That is the operating policy of the electrical department at Calumet & Hecla's tube plant in Decatur, Ala. Instead of shutting down an operation for an on-the-spot repair of a fuse or even a motor, the department's procedure calls for immediate replacement from spare-part stock. The troublesome part is returned to a centralized electrical maintenance shop for required work.

A 3-fold advantage has been found in this procedure: equipment downtime is kept to a minimum; maintenance work can be scheduled without pressure from the production department because of idled equipment; and it is more economical to do electrical repair work in the shop.

To facilitate centralized electrical maintenance and repair work, plant engineers at Decatur devised a highly versatile testing arrangement. Consisting of a simple work surface and panelboard supported by a simple channel iron frame, the set-up permits easy, convenient trouble-shooting and repair of malfunctioning equipment.

The testboard provides (1) outlets for testing regular and mogul base incandescent lamps, mercury vapor lamps and cold cathode fluorescent tubes in two lengths; (2) V-notch fuse tester; (3) small circuit continuity checker with a multiple switch to add resistance for current limit; (4) "Powerstat" variable transformer providing 0-250 volts ac single phase; (5) 110 ac and dc; 42 dc; 220 ac single-phase; 220-440 3-phase ac; (6) size 1 to 50-hp starters; (7) variable pushbutton for 42-volt dc clock system to simulate 24-hour operation; and (8) soldering iron specifically for use at the board.

Because of the flexibility and completeness of power and circuitry provided at the board, equipment can be tested, processed and repaired promptly.

Since this maintenance procedure has been in effect, it has proved to be faster, more economical and more efficient than doing the work in the production department and has permitted the electrical maintenance group to do a better job than under the previous more conventional system.

Floodlighting with Fluorescents

LIGHTING

Outdoor area floodlighting was included in the renovation plans of the John R. Thompson Co., Chicago, when they took over an existing property in Skokie, Ill., and remodeled it into what is now known as Holloway House Restaurant.

Original parking area lighting consisted of a few pole-mounted incandescent floods providing spotty and totally inadequate coverage. What Thompson selected and had installed was a system of fluorescent flood units on high standards which effectively combined area lighting with building exterior illumination.

As installed by M. Goldschmidt & Company, Chicago electrical contractor, the new system consists of a total of nine weatherproof fluorescent floodlighting units. Seven are mounted on 30-ft metal poles

FLUORESCENT FLOODS on 30-foot poles and roof standards for combination building and parking area lighting. Each weatherproof luminaire contains four 100-watt rapid start fluorescent lamps.

If TIME Figures In Your PROFITS-

Your wisest choice is the . . .

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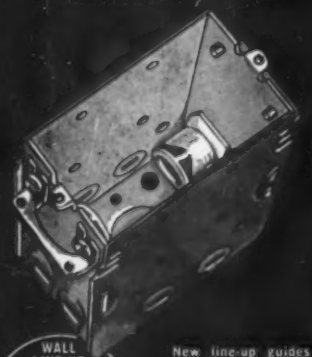
Non-Gangable

SWITCH BOX



WALL LINE-UP GUIDES
3/8" . . . .
1/2" . . . .
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New line-up guides help you install box easier, quicker and more accurately.

—other top features:

- Slotted cable knock-outs lift out clean and easy.
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- Available with brackets.

—an excellent box for your next job. Write for specification sheet.

Quality Needed for Tomorrow is in Arrolet Products . . . *Today!*

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NIGHT VIEW of restaurant property showing how floodlighting accentuates building structure and ample parking facilities.

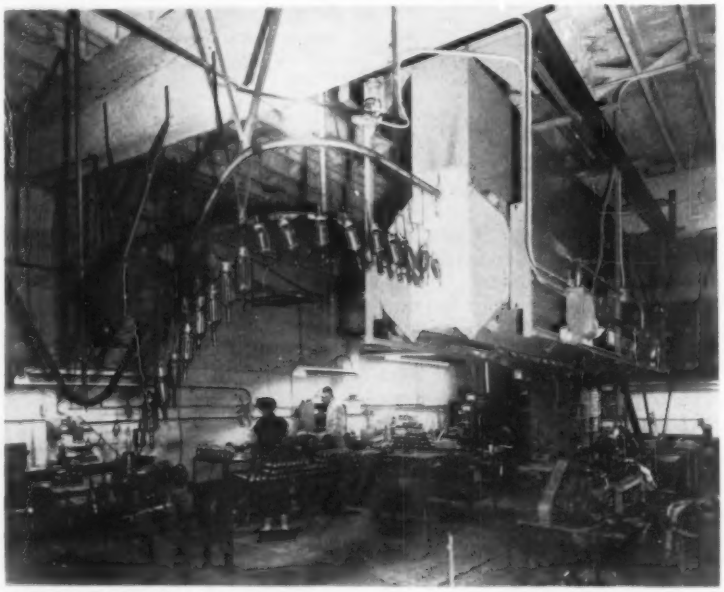
and beamed downward towards the lot and building. Two are mounted to short standards on the roof of two building wings. Each luminaire has an aluminum housing, specular Alzak aluminum reflector, four 100-watt rapid start, F72T12/CW/RS fluorescent lamps, and a hinged weather-tight glass enclosing cover. Luminaires were aimed at night at an appropriate angle to provide illumination on the face of the building as well as the parking lot surface. An average of 1½ footcandles of comfortable "soft" light cover the parking area.

Infrared for Drying Varnish

ELECTRIC HEATING

A shorter heating cycle and more effective drying of varnish on armatures are among the chief advantages obtained at Armature Rewind Company, Portland, Ore., by installing a Fostoria infrared baking oven.

A dipping operation is used to apply varnish to the armature windings. Varnish was formerly dried in an overnight bake in a convection oven. The firm's new 14-ft overhead infrared oven processes 6-volt and 12-volt armatures, as well as starting motors, in just 60 minutes. Sixty units are produced per hour. More efficient use



INFRARED OVEN provides faster, more effective baking of varnish-dipped motor armatures in Portland, Ore., rewind company.

of floor space is also provided through modernization made possible by the installation of the infrared oven.

Tests made by the firm indicate that varnish burn-off, required in preparing old armatures for rewinding, can also be accomplished faster by infrared heating in a process that takes only 20 minutes at 850°F. Drying out wet motors is another use for infrared heat.

According to Plant Manager J. A. Gay, "The penetrating nature of radiant heat—produced by infrared lamps backed with contoured gold-plated reflectors—assures complete removal of solvents, provides a finish bake that gives longer life to armatures and results in a product of higher quality."

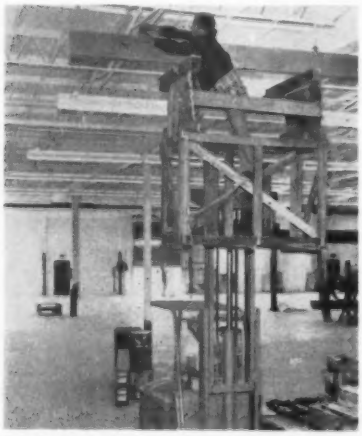
Lift Truck for Installing Busway

INDUSTRIAL

The use of a Yale gasoline powered industrial lift truck to lift and move materials and workmen greatly facilitated the installation of busway in the new Yale & Towne Manufacturing Company plant in San Leandro, Calif.

The busway, which carries electricity throughout the 100,000-sq-ft plant, comes in 10-ft sections weighing up to 350 lbs each. A special scaffolding platform was rigged to be picked up on the forks of the truck to aid in the installation.

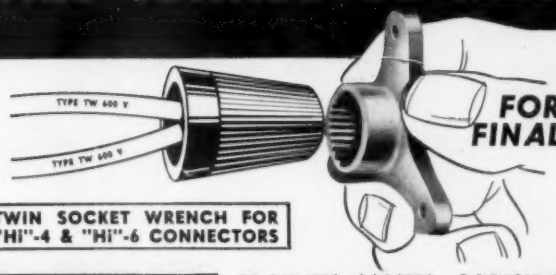
Another advantage to installing with a lift truck is the fact that the busway can be placed closer to the ceiling than is possible with an alternative block and tackle device.



LIFT TRUCK was used to raise and support busway for easy installation close to ceiling in new industrial plant.

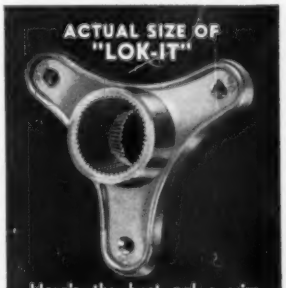
THERE'S NOTHING LIKE IT!

the NEW Hi "LOK-IT" WIRE CONNECTOR WRENCH



FOR THAT FINAL TWIST!

TWIN SOCKET WRENCH FOR "HI"-4 & "HI"-6 CONNECTORS



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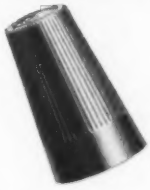
"LOK-IT" MAKES SCREW-ON WIRE CONNECTOR JOINTS SO TIGHT YOU CANNOT UNSCREW THEM WITH YOUR BARE HANDS!

All you do is slip "LOK-IT" over the knurled end of a "Hi" Bakelite Wire Connector and twist! "LOK-IT" does the work — saves your fingers . . . gives you a locking-grip on any wire combination . . . every job will pass the most critical inspection.

"LOK-IT" Wrench is an exclusive "Hi" product, specially designed to fit 2 sizes of "Hi" Screw-On Bakelite Wire Connectors — No. Hi-4 and Hi-6 ("standard" and "large" construction wiring sizes).

You can't buy "LOK-IT." See your distributor for FREE "LOK-IT"... Packed in Cat. No. Hi-46 pkg. of 100 each Nos. Hi-4 & Hi-6 Wire Connectors... or write to us for your FREE WRENCH PACKET!

"Hi" WIRE CONNECTORS



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1,000 Volts inside a sign or fixture... comply with National Electrical Code.

AND THAT'S NOT ALL—also U.L. listed as pressure cable connectors for general use in all types of branch circuit wiring—conduit, armored cable, non-metallic sheath, open and fixture hanging . . . machine hook-up, appliance repair, etc.

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OTHER "HI" QUALITY PRODUCTS
- Tape-Mate Winder
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Long life motors—And you get years of dependable operation from Century Electric motors. They are manufactured to rigid quality standards. Electrical tests and other checks on operating characteristics made during manufacture assure you the best motor for your money.

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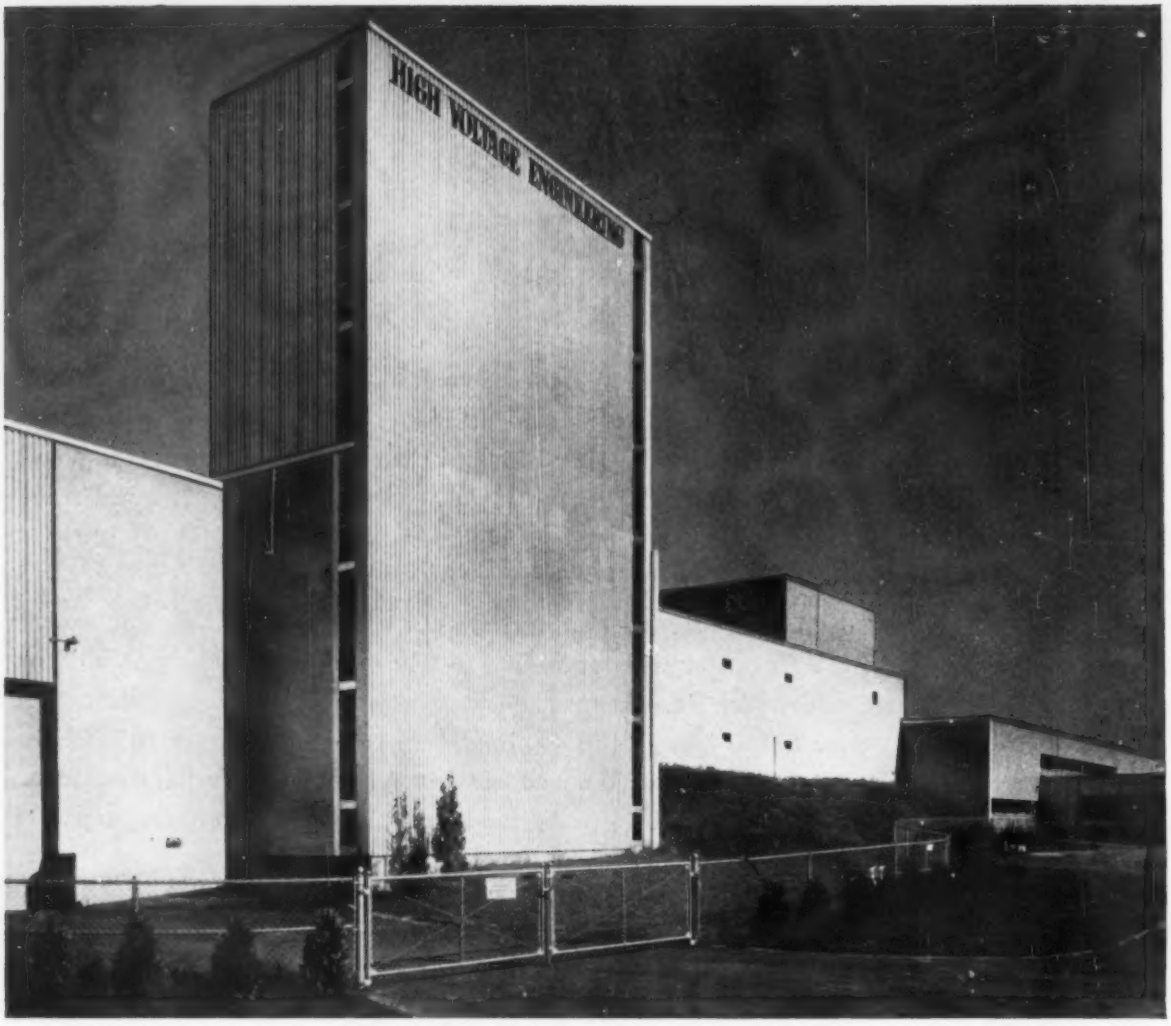

Partial View of the new plant on a 50-acre tract.

Architect: Carleton R. Richmond, Jr.; *Supervising engineers:* Stressenger, Adams, Maguire & Reidy; *General contractor:* Aberthaw Construction Co.; *Electrical contractor:* M. B. Foster Electric Co.

Another electrical manufacturer selected SORGEL dry-type transformers

for the operation of their plant

The HIGH VOLTAGE ENGINEERING COMPANY, in Burlington, Mass., the world's largest manufacturer of atom smashers, learned about the advantages of SORGEL dry-type transformers during an application with their product, which, on account of its nature, required the *best* transformers.

Being in a position to judge the quality of the transformers, they, like so many other electrical manufacturers, also selected SORGEL dry-type transformers for their own plant.

Complete line of dry-type transformers for every purpose

¼ Kva to 10,000 Kva — 120 to 15,000 volts

Quietest operation and high efficiency

•

Also special transformers, saturable reactors, and substations

Sales engineers in principal cities

SORGEL ELECTRIC CO., 836 West National Avenue, Milwaukee 4, Wisconsin

Over 40 years' experience in the development, manufacturing and application of transformers

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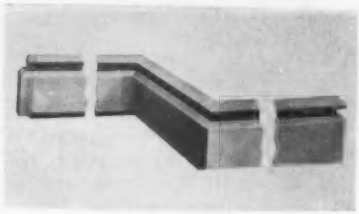
Product News



Baseboard Heater (1)

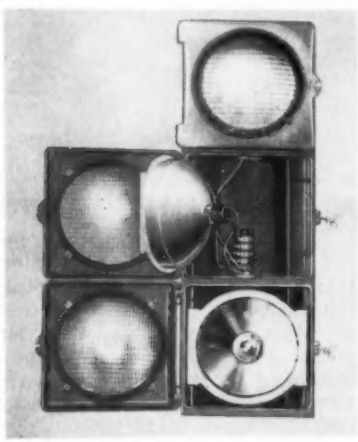
A new electric baseboard heater with panels in 2-, 5- and 8-ft lengths. They can be flush-mounted or recessed against the studding as desired in four easy steps. After the panel lengths are selected, back panel containing heating element is screwed or nailed into studs. Then power is connected to UL-approved splice box by bringing in two wires from rear, bottom or sides using raceway. Cover panel is then snapped in place.

Ilg Electric Ventilating Co., 2850 *N. Pulaski Road, Chicago* 41, *Ill.*

Connectors (2)

A new ⅜-in. twist-in flexible steel conduit connector for ⅜-in. Greenfield. The No. 300 is a companion piece to the ½-in. and ¾-in. twist-ins. Features include: positive ground — smooth interior and rounded throat—all steel construction.

Tomic Sales and Engineering Co., 20000 *Sherwood Ave., Detroit* 34, *Mich.*



Traffic Signal (3)

A new optical system, Model M-3 traffic signals, has an improved lens with high-polish Alzak aluminum reflector eliminating sun phantom. Adjustable focus receptacles allow for lamp variations. Unit is housed in a die-cast aluminum chassis enclosing 1, 3 x 3, 4 or 5 sections. Each section is self-contained with integral top and bottom, for individual removal and replacement. One-piece reflector assemblies snap in, snap out. When connection block is mounted in center section, heads can be used interchangeably for post or overhead signals. Model M-3 8-in. signals can be assembled with sections of the standard 12-in. signal.

Crouse-Hinds Company, Syracuse 1, *N. Y.*

Fluorescent Fixture (4)

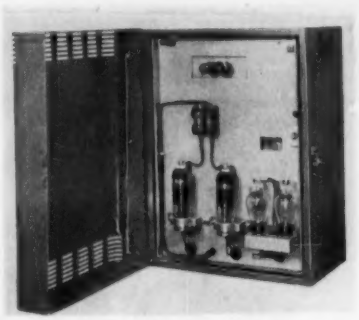
A new fluorescent fixture, named Sabre, is for commercial type interiors. It is a 2-lamp, 4-ft unit. Complete shielding and brightness control is obtained by the one-piece wrap-around refractor of prismatic, clear plastic. Its shallow depth makes it suitable for surface mounting but may also be suspended. In existing buildings present electrical outlets can generally be used. Refractor is removable for relamping and cleaning. Catalog is available.

The Miller Company, Meriden, Conn.

Gearmotor (5)

A new line of integral gearmotors in both the concentric shaft and right angle types for integral horsepower motors through 100 hp. Also a line of fractional horsepower, integral type right angle gearmotors. Integral units are available with either open or totally enclosed motors, double and triple reduction in standard ratios. A one piece, corrosion-resistant cast iron housing and rabbet-fit motor flange in the integral gear motors assure positive alignment of the motor and gears regardless of mounting position.

Allis-Chalmers Manufacturing Co., Milwaukee 1, *Wis.*



Voltage Drive (6)

A new anode-type adjustable voltage drive, featuring wide speed range (200/1) and close speed regulation ½% has been announced. Control circuit contains two control tubes—one for amplification, the other for voltage regulation. Other circuit elements are static or semi-conductor components. Drives are available as standard packages in sizes ranging from ¾ hp to 40 hp. Standard features include dynamic braking, dual voltage operation, and adjustable current (torque) limit control. Bulletin 8833 is available.

Square D Company, 4041 *N. Richards St., Milwaukee* 12, *Wis.*

Industrial TV (7)

A new line of closed-circuit TV for military, industry, business and education makes possible remote viewing of an action or process otherwise inaccessible or hazardous. Basic system consists of new and improved vidicon camera, monitor, and control unit. Camera features an entirely electronic light compensator, which instantly and automatically adjusts to compensate for light changes over a practical range eight times as great as normally covered by lens stops.

Industrial Products Div., International Tel. & Tel. Corp., 15191 *Bledsoe St., San Fernando, Calif.*

Cat. #652001

New Porcelain Products Pipe Mounting Wireholders

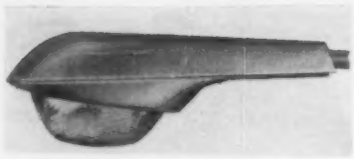
Porcelain Products *now* offers the finest universal pipe mounting wireholder available today. . . .

and here's why:

- Fits any 1¼" to 2½" pipe—ONE ITEM TO STOCK.
- Copper-bail reinforced insulator is stronger, with *extra* large wire holes—exceeds E.E.I. wireholder specifications.
- No loose parts—ready to install as is, on any size pipe.
- Bolts swedged rigidly to bracket for easy handling, installation.
- Slotted back bar permits installation without removing nuts.
- All steel parts are heavy gauge, hot-dip galvanized before assembly.
- Neat; trim, and compact for attractive installation.

Write for complete details

64 years PP Porcelain Products, Inc. CAREY, OHIO



Mercury Units (8)

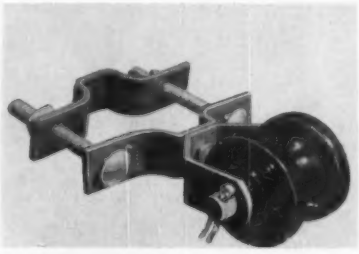
A new line of mercury luminaires for street lighting, designated OV-25 Silverline, are supplied with 400-watt mercury lamps, and are available with or without built-in ballast. They have one-piece die-cast aluminum housings. Two dual-voltage regulated output ballasts are available. In built-in-ballast models, transformer and capacitor compartments are separated by a heat barrier. Socket openings as well as reflector-refractor junctions are sealed.

Westinghouse Lighting Division, Edgewater Park, Cleveland, Ohio

Label (9)

A new self-sticking label especially designed for outdoor or permanent indoor use. Called MC Labelon, it consists of a pressure-sensitive card that can be written or typed upon, and then covered with an attached clear layer of outdoor type Mylar plastic for protection. Sizes range from ⅝- by 1½-in. up to 2- by 3¼-in.

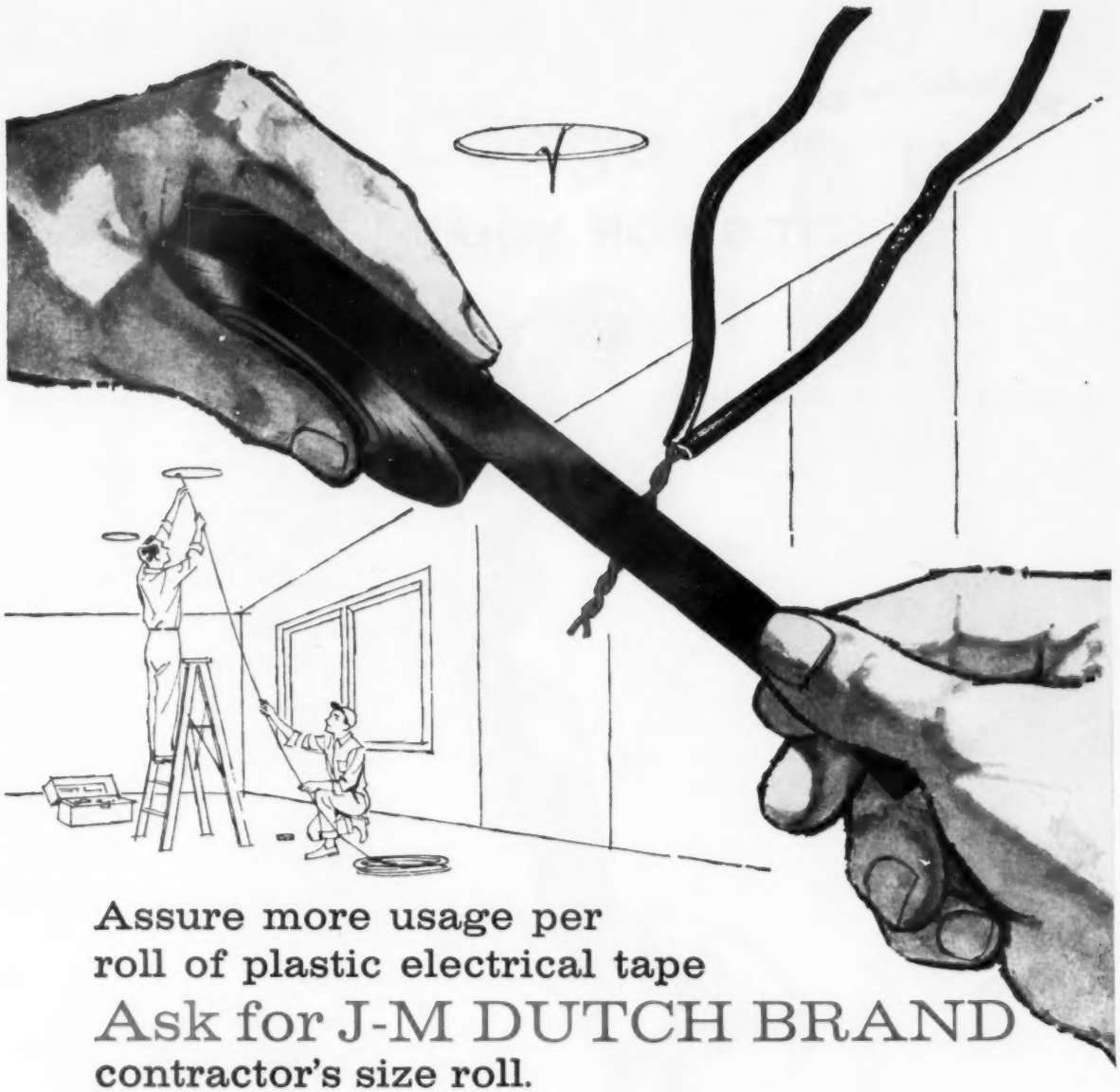
Labelon Tape Company, Inc., 450 *Atlantic Ave., Rochester* 9, *N. Y.*



Insulator Bracket (10)

Heavier service entrance drops can be tied to service masts using this new insulator bracket. Spool-type insulator utilizes wet-process porcelain to withstand heavier abuse than dry process types. Mounting for spool is a ½-in. removable pin, permitting easy insulator replacement without discarding the complete fitting. In addition, the pin-mounted insulator reduces vibration transfer to the mast and improves dependability.

M. & W. Electric Mfg. Co., Inc., East Palestine, Ohio



Assure more usage per roll of plastic electrical tape

Ask for J-M DUTCH BRAND

contractor's size roll.

Contractors find they save money with Dutch Brand's convenient packaging and complete line of tapes. For example, our contractor's-size roll of plastic electrical tape is a full 44 feet in length. This special size—exclusive with Dutch Brand—allows far greater economy in allocating materials to a job. Waste is cut to an absolute minimum for this is the length studies show a workman uses on an average job. Here's a worthwhile saving when you figure tape wastage per man and multiply it by the number of men in your crew. Yet, this 44-ft. roll costs you *no more* per foot than larger rolls.

Dutch Brand Plastic Electrical Tapes are available in 44-ft. and 66-ft. rolls. They're thin, strong, flexible—offer unusual resistance to acids, alkalies, oil, solvents, fungus, bacteria, gases. Made to meet the highest industry standards. Ask your supplier for Dutch Brand now. *Johns-Manville Dutch Brand Products, 7800 South Woodlawn Avenue, Chicago 19, Illinois.*

WRITE FOR NEW BOOKLET!

Looking for new ideas on tape as a time-and-money-saver? Ask for "Big Four in Electrical Tapes." Do it today!

JOHNS-MANVILLE

100 YEARS OF QUALITY PRODUCTS 1858-1958

JOHNS MANVILLE JM PRODUCTS

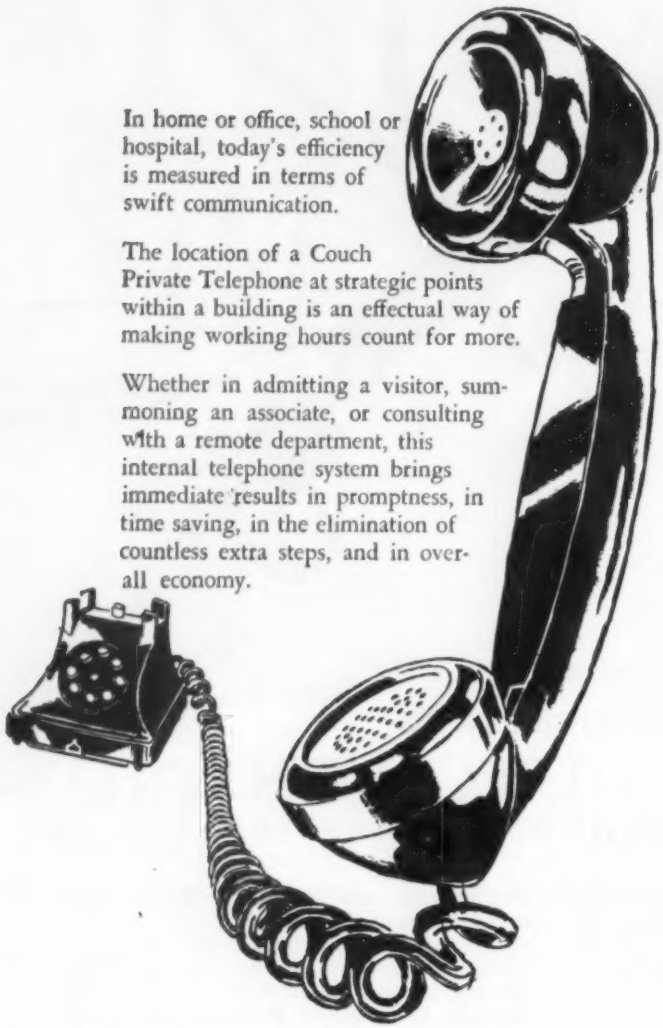
pick up the phone...

...IT'S FOR YOU!

In home or office, school or hospital, today's efficiency is measured in terms of swift communication.

The location of a Couch Private Telephone at strategic points within a building is an effectual way of making working hours count for more.

Whether in admitting a visitor, summoning an associate, or consulting with a remote department, this internal telephone system brings immediate results in promptness, in time saving, in the elimination of countless extra steps, and in overall economy.



Couch manufactures a variety of systems to cover requirements ranging from two stations up to 200. Designed as self-contained inter-communication units, Couch Private Telephone Systems provide consistent service and satisfaction.

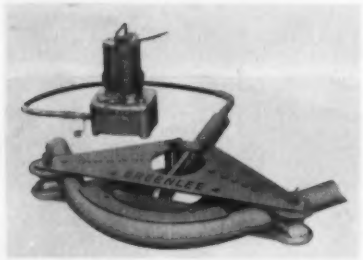
Write for Bulletin 133.

Couch

Simplified Systems of Communication

S.H.Couch CO., INC.

3 ARLINGTON STREET
NORTH QUINCY 71, MASSACHUSETTS



Bender **(11)**

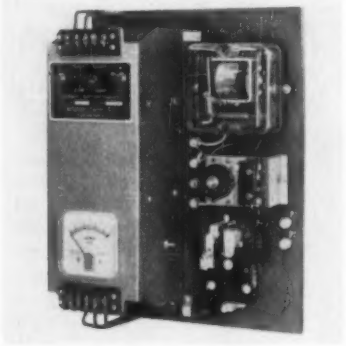
New No. 883 hydraulic bender bends ½-in. to 3-in. pipe and conduit up to 90° with one ram stroke. One set of pipe supports rotates to take all sizes. Bender is wheeled from job to job on pipe supports, which are designed to serve as rollers. Built-in ram gauge facilitates making identical bends. Attachments for bending thinwall conduit and bus bar and a reverse shoe for correcting overbends are available.

Greenlee Tool Co., Rockford, Ill.

Instrument **(12)**

The Amprobe Deca-tran is designed primarily for use with any Amprobe where an extension of ranges is needed. The Deca-tran can be used to multiply your Amprobe's versatility by 10. Readings can be taken on conductors as large as round 2⅞-in. diameter, and bus bar ¾ by 2½ in. Readings can be taken at the conductor at a distance of 2 ft.

Pyramid Instrument Corp., 630 Merrick Road, Lynbrook, N. Y.



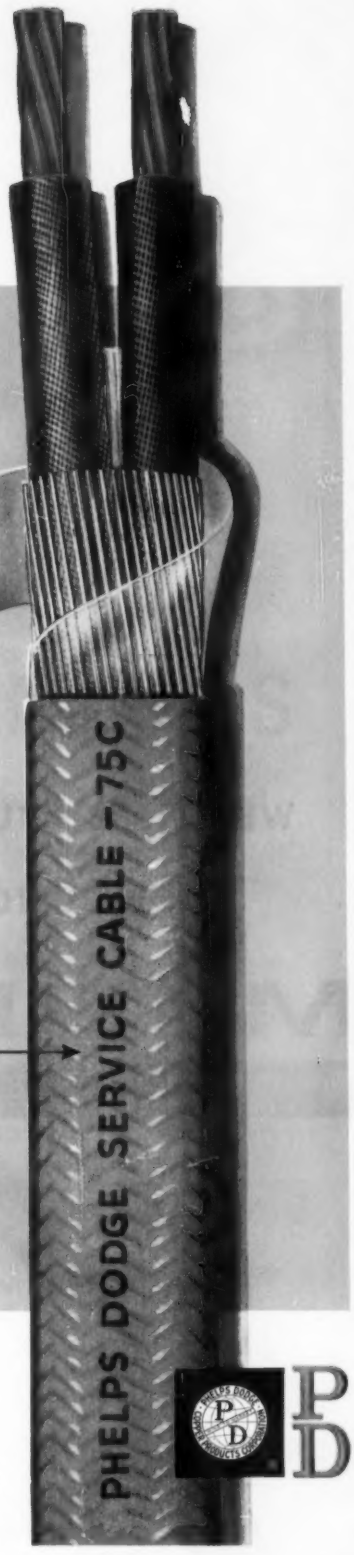
Battery Charger **(13)**

A new 6-amp battery charger, Bulletin 237S, brings batteries up to full charge, and automatically disconnects batteries when they attain proper voltage values. They are available for input voltages up to 600 volts, 60 cycles, for batteries rated from 6 through 32 volts.

Automatic Switch Company, Florham Park, N. J.

Electrical Contractors acclaim

Phelps Dodge SE-U Cable with Mylar* tape!



The new SE-U type cable with Mylar tape and an improved outer compound, developed and introduced by Phelps Dodge, has received enthusiastic approval from electrical contractors and chief state electrical inspectors. Here are some comments about this remarkable cable picked at random from field reports:

"It is much more flexible . . . ease of stripping is made easier on this new type . . . a definite improvement over the old type."

"We found it to be superior in several ways to the kind of cable we have been using. It is more flexible and easier to strip . . ."

"Phelps Dodge entrance cable . . . proved to be much more than we could possibly expect. The ease of 'skinning' and handling were what we have been looking for in an entrance cable."

MYLAR TAPE FOR
More flexibility • Better moisture resistance
Lower shipping weight • Lighter, less bulky cable

GRAY COMPOUND FINISH
gives better cable appearance; will not stick in hot weather, will not crack or flake in cold weather.

Phelps Dodge entrance cable with Mylar tape has received Underwriters' Laboratories Approval.

See your Phelps Dodge Distributor!

*Mylar is Du Pont's registered trademark for its brand of polyester film.

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Detroit, Fort Wayne, Greensboro, N.C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N.Y., San Francisco, St. Louis, Seattle, Washington, D.C.

PD

ACTUAL SIZE MARK 75 HF FRAME

WESTINGHOUSE

ANNOUNCES

MARK 75

Now! Molded Case Circuit Breakers that interrupt 75,000 amperes

Available at only a fraction of the cost of other high-interrupting capacity breakers!

This is news that can literally save you thousands of circuit breaker dollars. Westinghouse has developed a new molded case breaker line, the MARK 75, that can be used on high-power applications up to 75,000-amp capacity (240 v a-c).

The MARK 75 exclusively gives you . . . an extremely high-interrupting capacity molded case breaker . . . without reactors or fuses . . . at a fraction of the cost of equivalent devices . . . in the same frames, and interchangeable with the standard line of Westinghouse AB circuit breakers (see actual size illustration at left).

You can order MARK 75 circuit breakers in three frame sizes—HF, HKL and HLM—by contacting your nearby Westinghouse sales representative. Or by writing: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

If you'd like information on other major Westinghouse circuit breaker innovations of 1958—Saf-T-Vue*, Tri-Pac*, JK and JKL—ask us for bulletins on these also.

*Trade-Mark

J-30261

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

We're Still Looking for an **Electrician** Who Doesn't Prefer

RIDGID®

"Of Course I said RIDGID ... It's the only wrench for my conduit . . . and my money!"

At your Supply House

The Ridge Tool Company Elyria, Ohio, U.S.A.

THREADED PIPE... *It's Tight... It's Best... Costs Less!*

Roof Ventilator **(14)**

A new series of direct drive and belt drive centrifugal roof ventilators designed to move large volumes of air quietly and continuously at moderate static pressures. For commercial and industrial ventilating systems, units have been designed to provide an architectural blend with modern roof lines. Features are—all steel housing; bird screen of ½-in. mesh; airfoil contoured wheel blades; floating wheel and drive motor; ball bearing motor; ventilated motor compartment; variable pitch pulleys; external conduit arrangement; disconnect switches.

Power Line Fan Company, Plainfield, N. J.

Hoist **(15)**

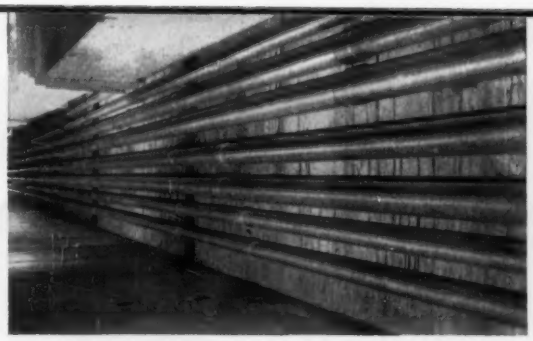
A new self-erecting alumium material hoist, called Liftamatic. Unit has telescoping aluminum rails that provide adjustable unloading heights from 13 to 40 ft. Can be supplied with either 18-ft or 25-ft inner sections and 16- or 25-ft outer sections. Available with reversible electric motor, having 80 ft per minute line speed; or with 7½-hp gasoline engine and centrifugal-type governing down-brake having 125 ft per minute line speed. Both models have remote control and adjustable limit stops to enable platform to stop at predetermined loading and unloading levels.

Sasgen Derrick Co., 3101 *West Grand Ave., Chicago* 22, *Ill.*

Vise **(16)**

A new Ridgid top-screw chain vise, No. 450 portable Tristand, features a large chain tightening handle on top of vise base. Weighing 42½ lbs the unit has a capacity of ⅛ to 5 in. Folding legs with built-in tray are easy to set up and lock in position.

Ridge Tool Co., Elyria, Ohio



Bank of Youngstown "Buckeye" Steel Conduit in tunnel of Carrier Administration Building will protect important electrical wiring for lifetime of the structure.

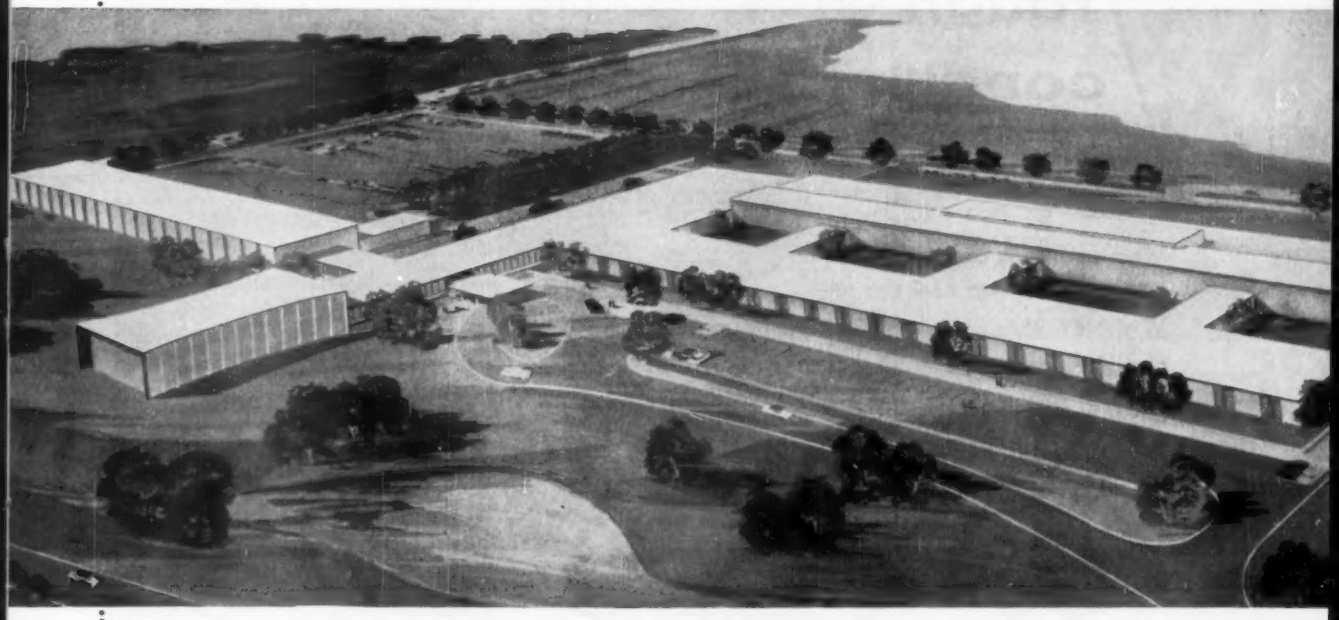
Accent on Excellence

Youngstown "Buckeye" conduit

This modern, highly functional Administration and Research Center located at Syracuse, New York was recently completed by Carrier Corporation, leading producer of air conditioning, refrigeration and heating equipment.

To guarantee against failure of the center's all-important electrical system, Youngstown Full Weight Rigid Steel "Buckeye" Conduit was selected to protect

Carrier



Administration and Research Center, Carrier Corporation, Syracuse, New York

ARCHITECTS AND ENGINEERS: Schmidt, Garden and Erikson
Chicago, Ill.

CONSULTING ARCHITECTS: Carson & Lundin
New York, N.Y.

ELECTRICAL CONTRACTORS: Bec Electric Company
Syracuse, N.Y.

CONDUIT SUPPLIER: Baldwin-Hall Company
Syracuse, N.Y.

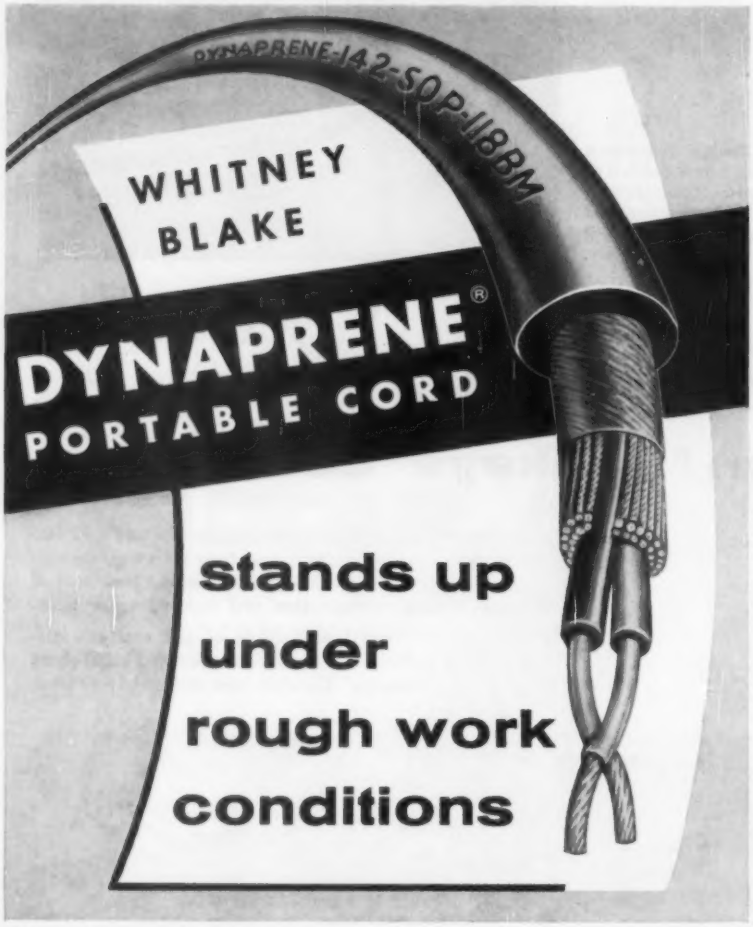
all wiring from damaging elements such as water, moisture, vapor, dust and dirt. That's because steel conduit is today's *only* method of wiring protection approved by the National Code covering all electrical installations.

When you specify "Buckeye" Conduit, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create electrical wiring systems with an "accent on excellence".

QUALITY YOUNGSTOWN SERVICE

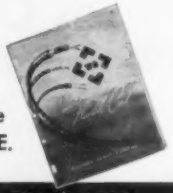
THE
YOUNGSTOWN
SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel
Youngstown, Ohio



Where portable cord takes a beating because of rugged work conditions, WHITNEY BLAKE DYNAPRENE stands up and gives long, economical service.

DYNAPRENE has an especially tough neoprene jacket, it resists abrasion, has high flexibility and long flex life, and provides premium quality service at competitive prices.



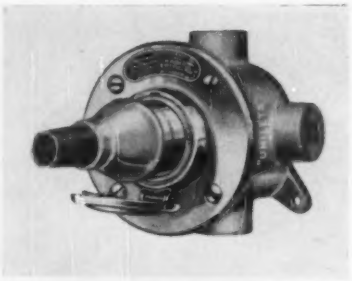
Write TODAY for this complete catalog . . . FREE.

WB

WELL-BUILT WIRES SINCE 1899

WHITNEY BLAKE COMPANY

NEW HAVEN 14, CONNECTICUT



Dead-End Receptacle (17)

A dead-end contact feature for "CPS" Series explosion-proof receptacles for flush wall mounting has been developed. In this unit any arcing is confined within a plug combustion chamber of the dead-end receptacle. Dual protection is afforded the user by elimination of live contacts exposed to the atmosphere. Type "CPSH" receptacles are available with or without adjustable sleeve to accommodate varying wall thicknesses and include Unilet and close-up plug. Conduit hub sizes range from ¾- to 1-in. for single phase, 2-wire, 3-pole circuit and for 3-phase, 3-wire, 4-pole.

Appleton Electric Company, 1701 *Wellington, Chicago, Ill.*

Thinwall Bender (18)

A new ½-in. thinwall hand bender has two spirit levels built into the shoe itself to provide accurate indication of 45- and 90-degree bends. The levels used in the shoe have pyrex vials that will take shock, abuse and rough handling and will withstand cold and hot climate extremes. The bender is made of light weight, high strength aluminum alloy to provide easy carrying and handling.

Gardner Bender Company, 5448 *North 24th Place, Milwaukee* 9, *Wis.*

Power Units (19)

New ac to dc rectifier power units, regularly available with selenium rectifiers only, have been improved to include the choice of silicon rectifiers as well. Standard 3-phase units are available in kw capacities ranging from ¾ to 500 for single units. Larger capacities are possible with combinations of units. Single-phase unit watt-outputs range from 250 to 3000. Special low voltage power units offer capacities of from 1,000 to 10,000 amps in standard 6, 9, 12, 18, 24 and 48 volts dc.

Syntron Company, 690 *Lexington Ave., Homer City, Pa.*

B-M THE ORIGINAL INDENTER FITTINGS

Over 25 Years of Proven Performance

Permanent locked-in bushing insures smooth burr-free raceway for easy fishing. No extra work.

BRIEGEL RED THROAT

1. Protruding rounded red plastic lip of bushing prevents cutting of insulation—eliminates shorts.
2. Full thread screws into all conduit fittings. Lip of RED THROAT bushing protects thread from damage.
3. Deep dished eight pronged lock nut is easier to drive on—screws flush to shoulder and digs into metal of box for vibration proof positive ground.
4. Two quick squeezes with The Briegel Indenter and BM All Steel Indenter Fittings are set forever. Metal is pressed into metal for permanent installation and positive ground.

NEW POCKET SIZE INDENTERS

Just 10" long, these new patented compound leverage indenters are only plier size. Lighter to carry and easier to use—the leverage does the work. No. 607 for ½" and No. 608 for ¾" fittings.

BRIEGEL METHOD TOOL COMPANY

GALVA, ILLINOIS

All B-M Indenter Fittings are U.L. Approved as concrete-tight and for general use (File Card E10863). Also comply With Federal Specifications W-F-406.

ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT

POSITIVE
TIME-DELAY PROTECTION

Shawmut "t-d" Renewables have the best time delay characteristics of any renewable fuse. The t-d link gives maximum time delay protection in the higher current ranges as well as in the overload zone. Short-circuit operation is instantaneous, along with a reduction in the rate of rise of recovery voltage. The t-d link notches blow one after the other with rheostat-like action.

HIGH QUALITY - LOW COST

Precision-made. No soldered, welded or steel parts. Simple, sturdy, dependable. Easy to install, take apart or renew. Interchangeable links, renewable parts. Large silver-plated contacts. Adequate 2-way venting.

COMPLETELY RENEWABLE
FUSE OR LINK

Complete fuses and/or renewal links are available for either 250 or 600 V circuits; in ferrule ratings, from 0-60 Amps.; in knife-blade ratings, from 70 to 600 Amps.

Order now or ask for t-d Bulletin 500

*U.S. Patent No. 2,560,138 © The Chase Shawmut Co. 1958

t-d - Hunkie At The Switch

THE CHASE-SHAWMUT CO.
374 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS
Subsidiary of I-T-E CIRCUIT BREAKER CO., Philadelphia, Pennsylvania

Amp-trap® Tri-onic® t-d® C-O-T® TRIONET® and O-T TYPE

Combination Lock **(20)**

New electrical combination lock is burglar-proof. Only by rotating the dial knob in the proper sequence of numbers can anyone gain access to a building, operate burglar alarm system, use equipment, machinery, etc. Can be installed singly or in a series by connecting with present electrical system. Available in three finishes: chrome, black enamel or gold anodized.

Max-A-Loc, Inc., El Monte, Calif.

Limit Switch **(21)**

A new oil-tight roller-plunger operated plug-in limit switch features a micrometer adjustment which permits up to ½ in. movement of roller position after limit switch has been installed. Roller operating direction can be changed 90° to allow for a cam approach perpendicular to the base of the switch. It can be mounted in any one of six arrangements. Switch is built to provide dependable operation on applications where camming is from a side angle. Switch requires 5½ sq in. of mounting space. Bulletin 9007 is available.

Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.

Lighting Unit **(22)**

A new luminaire for street, highway and parking lot usage, known as the "Metropolitan". Unit uses either clear or color-improved 100-, 175- and 250-watt mercury lamps. Available with IES-ASA Type I, Type II and four-way Type II distribution patterns. Three optional features are available—an integrally-mounted twistlock photocontrol; an autotransformer or choke ballast, also integrally-mounted; and power-factor correction for the ballasts.

Wheeler-Fullerton Lighting Div., Wheeler Reflector Co., Boston, Mass.

RACO

You Can Always Rely On RACO

ADJUSTABLE BARS

✓ QUICKLY POSITIONED

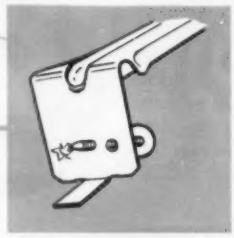
✓ EASILY INSTALLED

✓ SAVES TIME

NEW STOP-LOCK

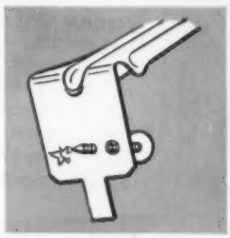
Prevents bar from slipping apart accidentally. Permits separation of bar if desired.

SELF-GAUGING



SHALLOW OFFSET

Place gauging lug against edge of rafter or joist and nail in place.



DEEP OFFSET

Straighten gauging lug and line up flush with edge of rafter or joist.

SERRATED NAILS ARE PRE-ASSEMBLED TO THE BAR

Ready for immediate installation.
No hunting for nails.

✓ EXTRA STRONG

THE ONLY BAR ON THE MARKET WITH RIGID "M"* CONSTRUCTION

RACO Adjustable Bars have been vastly improved. Note these extra advantages . . . pre-assembled serrated nails for easy installing . . . self-gauging lugs for fast positioning . . . friction stop-lock that prevents bars from accidentally slipping apart. High quality electro-galvanized finish. Write today for new bulletin describing these superior Raco Adjustable Bars.

ONLY 4 BARS DO THE WORK OF 16

Simplifies stock control . . . requires less investment in inventory. Two sizes fit most every job.

RACO

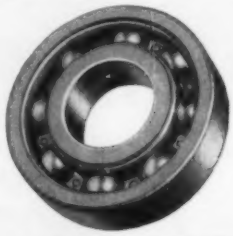
ALL-STEEL EQUIPMENT INC. Aurora, Illinois

FOR FASTER, BETTER MOTOR REPAIR JOBS...

USE WAGNER REPLACEMENT BEARINGS

When you use genuine Wagner replacement sleeve bearings you are assured of getting the finest quality in bearings that fit right every time—Why? Because Wagner replacement bearings are exact duplicates of the originals. They're steel-backed, 85% tin babbitt-lined and are precision bored to size. They won't seize or grab and they don't corrode.

BALL BEARINGS. The ball bearings used in Wagner motors are the finest we can buy, and are exactly right for the motor in which they are used. Always replace worn or damaged bearings with the same high quality ball bearings furnished originally.



SLEEVE BEARING REPLACEMENT IS EASY... WITH THE WAGNER BEARING TOOL

This time-saver lets you drive out the worn sleeve bearing and install a new Wagner bearing in a single, easy operation. No reaming is necessary—you get perfect alignment every time.

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

WR59-1

Wagner Electric Corporation
OVER 850 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS
MOTORS • BEARINGS • STANDARD ROTORS
BRUSHES • CAPACITORS • COMMUTATORS

Capacitors (23)

A new high voltage housed capacitor equipment comprised of standard sections mounted on a continuous base. Basic section contains 1200 kvar of capacitors and interlock and grounding device. Additional capacitor sections rated 1200 kvar each can be included in the factory-assembled equipment or added in the field to bring the total kvar rating to 3600 for a 5 kv class equipment, and up to 6000 kvar for a 15 kv equipment. Capacitors are mounted in a horizontal position behind housing doors. New equipment is 109 ins. high; roof of the equipment is sloped to drain rain water. A thermostatically controlled fan at bottom of each 1200 kvar capacitor section operates when ambient temperature actuates a factory pre-set thermostat. An auxiliary thermostat for an alarm or breaker trip circuit is also provided.

General Electric Co., Schenectady 5, N. Y.

Switch (24)

"Sierra-lite" silent mercury switches feature a toggle that emits a soft glow whenever it is in the "off" position. Inside the toggle is a neon glow lamp. Switch may be wired either from the top or back depending upon the installation, and is available in both single pole and three-way.

Sierra Electric Corp., 15100 South Figueroa St., Box 85, Gardena, Calif.

Motor (25)

A new dc heat exchanger motor designed to provide a wide adjustable speed range. Motor is also intended for constant speed applications and is available in ratings from 25 to 300 hp. Motor is constructed in an explosion proof enclosure (Class I, Group D, Underwriters Label) for hazardous installations and with standard enclosed construction. Motor is designed for indoor or unprotected outdoor service. Heat exchanger tubes of heavy-section, high tensile strength aluminum alloy are distributed around the periphery of the field ring for air-to-air heat removal. Motor can be mounted floor horizontal, wall or ceiling horizontal, or vertical with shaft up or down. Bulletin No. 3000 is available.

The Louis Allis Co., 427 E. Stewart St., Milwaukee, Wis.

Pipe Threader (25A)

Rigid No. 161, 4- to 6-in. geared pipe threader has been added to this line. It threads all four sizes, 4-, 4½-, 5- and 6-in. pipe or conduit with one set of dies that are cam activated. Two spring knobs lock dies at thread size. Easy adjustment for straight or tapered threads. Fully adjustable for over or under size threads. Designed for power drive or hand operation, No. 161 is regularly equipped with a ratchet handle.

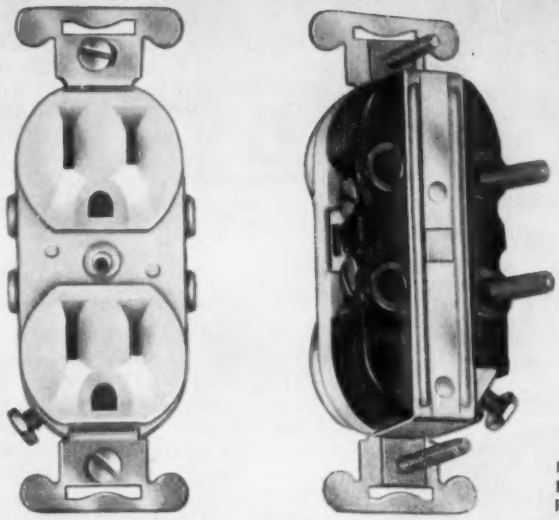
Ridge Tool Company, Elyria, Ohio

Electric Heater (25B

A new fan-driven, electric wall insert heater featuring small dimensions and high heating capacity. Intended for motel, home and office-type installations, unit measures 22⅜ in. high, 16⅜-in. wide and extends 1½ ins. into the room. Wall housing dimensions are 20¼ ins. high, 14½ ins. wide and 3½ ins. deep. Three sizes are available delivering heating capacities of 6824, 10,236 and 13,648 Btu/hr output. Unit has an integral thermostat with 55-85° range. A separate "on-off" switch is provided which permits automatic operation without disturbing thermostat setting.

Ilg Electric Ventilating Co., 2850 N. Pulaski Road, Chicago 41, Ill.

NOW! Leviton adds back and side wired devices to the specification (5000) grade line!

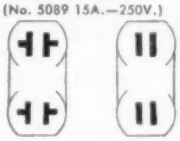


No. 5096
Duplex U-Ground
Parallel receptacle

LOOP IT OR DO IT THE EASY WAY!

LEVITON back-and-side wired devices offer two types of connections. Loop it the standard way, or clamp it for back-wiring—the new simple and modern way that gives you a connection that is electrically right and mechanically tight. Either way you are assured the right kind of power to carry heavy duty loads. Here is the maximum in performance at minimum cost . . . with absolutely no compromise in quality!

Back-and-Side Wired Devices Now Available:
Rated 15A.—125V.
(No. 5089 15A.—250V.)



No. 5062 No. 5074

No. 5088 No. 5089

Just Check These Features:

- All devices have double-wiping phosphor bronze contacts.
- Plaster ears—wide and break-off types.
- Grounding Screws on all U-Ground devices.
- Entire assembly solid-riveted for permanence.
- Heavily sectioned molded phenolic bases.
- Full underslung straps, completely *rust-proofed.*
- Easy back-wired installation for up to No. 10 wire.
- Strip gauge for obtaining maximum clamping.
- Individually packed with mounting screws attached to straps.

Meet U. L., C. S. A., and Federal Specifications
All back-and-side wired devices in brown and ivory.

Listed by Underwriters' Laboratories

Your best jobs are done with...

LEVITON MANUFACTURING COMPANY, INC.
Brooklyn 22, New York

LEVITON

Chicago • Los Angeles • Leviton (Canada) Limited, Montreal

For your wire needs, contact our subsidiary AMERICAN INSULATED WIRE CORP.

NATIONAL PRICE SERVICE

Now offers you a choice of price books —

The Blue Book

lists current cost prices of electrical construction materials and suggests resale prices to insure a fair profit to your business.

-or-

The Red Book

lists current cost prices only for estimators and purchasing agents.

••••••

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Blue Book☐ Red Book☐ Both☐

Name _____
Title _____
Company _____
Address _____
City _____ Zone _____ State _____

Fitting (26)

All-aluminum "Speedolet" service entrance fitting is available in all sizes from ½ in. through 4 ins. Series STFB in sizes ½ in. through 2 ins. are furnished with adaptors for thinwall installation. UL—CSA approved.

Killark Electric Mfg. Co., Vandeventer and Easton St., St. Louis 13, Mo.

Distribution System (27)

An overhead distribution system, called the "Trimline" primary distribution system, features a Plexiglas supporting spacer, extruded high molecular weight polyethylene insulated phase conductors, and a high strength supporting messenger. The system is intended for both utility and industrial distribution circuits ranging from 5 to 15 kv. A single size spacer is used for all voltages up to 15 kv. This is made possible because of a 6-in. spacing between phase conductors and the interchangeability of the neoprene grommets. Grommets of different sizes are available to accommodate the various phase conductor and messenger diameters up to 15 kv. Phase conductor sizes for 5 kv circuits range from No. 4 AWG to 397.5 MCM and for 15 kv circuits from No. 4 AWG to 266.8 MCM. Spacers are placed approximately 30 ft apart along entire length of distribution system.

Rome Cable Corp., Rome, N. Y.

Electric Heater (28)

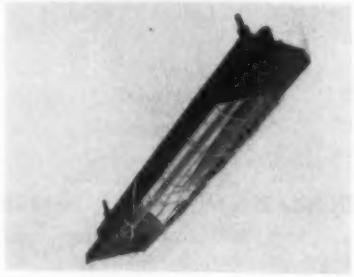
Electric insert duct heater is specifically designed for use with package air conditioning units and other similar applications. Duct heater consists primarily of safety grid heating element, mounted on heater outlet box. It is corrosion treated and finished in gray enamel. A removal cover provides access to terminals. Unit has a safety switch which automatically breaks the service to the heater in the event of stoppage of air flow through the heater. It is an automatic reset type. Safety switch is mounted for positive action. Made in two models: the DH-3 with a capacity of 3 kw and the DH-5 with a capacity of 5 kw, and operated on 240 volts, single or 3-phase.

Electromode Division of Commercial Controls Corp., 570 Culver Road, Rochester 3, N. Y.

Voltage Regulators (29)

A complete line of single-phase step voltage regulators in 27 distribution ratings, for pole-top, station and platform installations. The "Pole Star" regulator is designed to provide maximum user-convenience as well as efficient, automatic voltage regulation in 32 steps of ⅝% each. Available sizes include voltages from 2500 through 14,400 volts and current ratings from 15 through 668 amps. Regulators with current ratings above 320 amps are equipped with a direct-drive tap changer. Both direct-drive tap changer and spring-drive tap changer used on lower rated regulators have arc-resistant contacts and operate at controlled speeds that reduce contact erosion.

Pennsylvania Transformer Div., McGraw-Edison Co., Canonsburg, Pa.

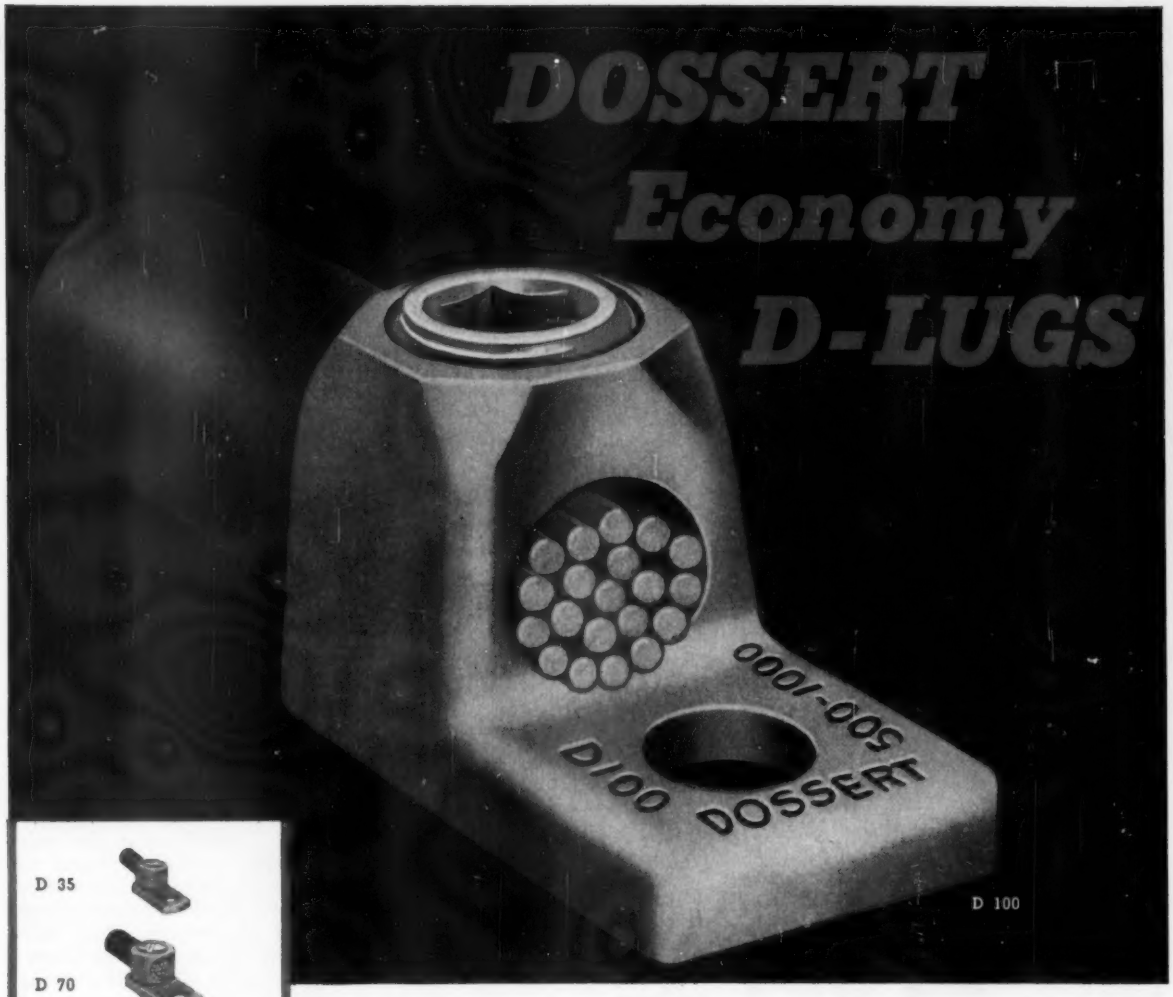


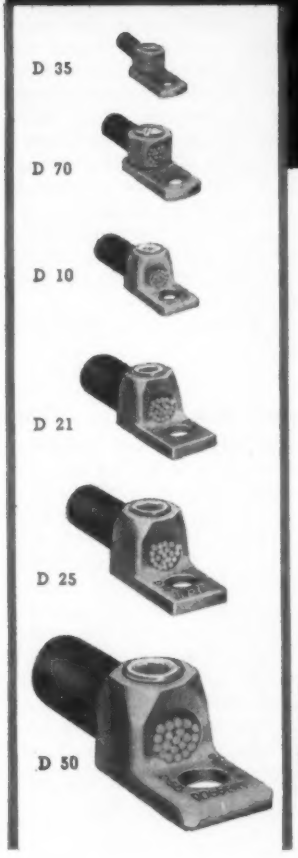
Infrared Heaters (30)

Infrared radiant heaters for comfort heating and many drying applications. Infrared heat source is a tubular heater mounted in a metal frame with a bright reflector. Sliding steel clamps can be positioned anywhere along heater length. They are mounted through holes drilled in angle irons or other supports. Units are rated from 600 to 1800 watts in a wide range of overall lengths from 24⅜ ins. up to 46⅜ ins.

Vulcan Electric Co., 88 Holten St., Danvers, Mass.

DOSSERT Economy D-LUGS





Here is a complete and low-priced line of D-LUGS. These connectors are more compact and heavier in weight to insure cooler operation under more severe loads, while being much easier to install. Only seven sizes accommodate from 14 SOL. to 1,000,000 CM.

FEATURES:

- **Rugged construction**
- **Made of high conductivity copper alloy**
- **Suitable for all purposes**
- **Variable, each connector takes wide range**
- **Exceptionally compact**
- **Reusable**

Write for detailed information and prices!

50 YEARS OF TECHNICAL KNOW-HOW

DOSSERT MFG. CORP.

249 Huron Street, Brooklyn 22, N. Y. Representatives in all principal cities

IN CANADA: W. S. Gerrie & Assoc., Ltd., Toronto

YOU CAN DEPEND ON
ROYAL ELECTRIC
PORTABLE CORD

Put it to the test on your work . . . see for yourself why so many leading contractors and maintenance men insist on Portable Cord and Cable with the familiar and trusted Royal brand. You'll find Royal goes all the way to produce easy-working, long-lasting cord . . . with durable, handy packaging for maximum protection and time-saving workability.

Check your cord and cable stocks, today. See your Wholesaler about Royal Rubber, Neoprene, and Plastic-Jacketed Cords . . . Royal Thermostat Cable . . . Royal Machine Tool Wire . . . Royal Lamp and Fixture Wires . . . and Royal "Powr-Kord" Heavy Duty Extensions. Or write for catalogs, giving wholesaler's name.

ROYAL ELECTRIC
...an associate of

ROYAL ELECTRIC CORPORATION • PAWTUCKET R. I.

Tool Compartments (31)

Series TC-Tool compartments are designed for universal mounting on any pickup truck or flat bed vehicle. Fabricated of heavy gauge steel, they are so constructed they can be bought individually or in pairs. Series TC convert an ordinary truck into a service vehicle by adding lockable and protected carrying space for tools, parts and other equipment. Available in two sizes, Model TC-72 for ½-ton pickups and TC-84 for ¾-ton pickups.

Utility Body Co., 1530 *Wood St., Oakland 7, Calif.*

Motor Base (32)

Three new sizes of tension control motor bases are available that can handle NEMA frame motors up to and including 100 hp. These all steel mountings, called Econ-O-Matic motor bases, automatically control belt tension and eliminate belt slippage and speed losses at peak loads. Each of the three sizes consists of a cradle-type motor base supported on built-in slide rails with screw take-up. Cradle is pivoted in ball-and-socket self-aligning bearings to insure free movement without danger of freezing or binding. Motor bases, designated 9K, 11K, and 13K, take NEMA motor frame sizes up to Nos. 405, 445 and 505 respectively.

American Pulley Co., Philadelphia, Pa.

Lampholder Box (33)

Engraved legends are brightly indicated when back-lighted in new, space-saving "DR" multiple lampholder box. Die-cast aluminum box frame, 5 ins. by 1⅛ ins. overall, accommodates up to six "window" areas replacing individual indicating lamps. T3¼ miniature bayonet lamp bulbs are used for low voltages, S6 candelabra screw-base bulbs for 120-volt service. Legend plates are available in white on black or black on white. Boxes are easily mounted together for vertical or horizontal annunciator applications.

H. R. Kirkland Co., 8 King St., Morristown, N. J.

From the heart of the Nation . . .

LACLEDE

CONDUIT AND EMT

- From America's most modern continuous weld pipe mill
- Manufactured to all standard specifications
- Sizes up to 6"

ORDER FROM YOUR DISTRIBUTOR

LACLEDE

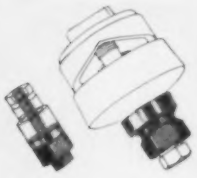
LACLEDE STEEL COMPANY

SAINT LOUIS, MISSOURI ◆ Producers of Steel for Industry and Construction

INCREASE PROFITS, SPEED UP WORK SCHEDULES WITH GREENLEE KNOCKOUT TOOLS

***NEW...* Ratchet Knock-out Driver 6 Times Faster!**

Antifriction fast-lead thread gives super-fast cutting by hand. Ball bearing high-leverage ratchet action — easy operation of all GREENLEE Knockout Punches for ½" - 3" conduit. Comes in metal box — No. 1804 without punches; No. 1806 with punches, ½" - 2".



FAST
Ball Bearing Drives

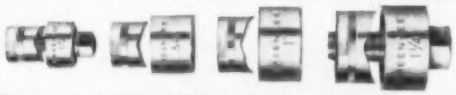
Reduce friction, minimize time and effort needed to operate GREENLEE knock-out punches with wrench. There is a ball bearing drive to fit every GREENLEE punch.

GREENLEE has the right knockout tool for every job!

Make openings in seconds with the GREENLEE hydraulic knockout punch driver!

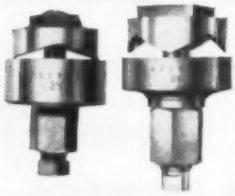
No. 7646-A Hydraulic Knockout Punch Driver is a lightweight, portable unit specifically designed for driving all standard GREENLEE knockout punches. Develops 11 tons of ram pressure for high-speed cutting through metal up to 10-gauge. The one driver operates all sizes of knock-out punches for ½" - 5" conduit. Comes in a metal carrying case. Handy sets include up to 10 GREENLEE Knockout Punches.

Which of these handy sets can save you the most?



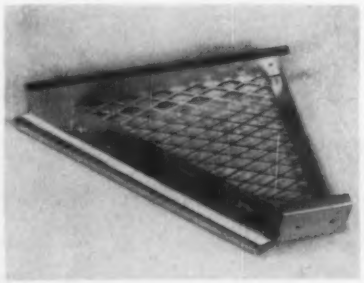
Famous GREENLEE Knockout Punches

Make openings for all standard conduit sizes ½" - 5". Fast, easy cutting through metal up to 10-gauge. Every cut is quick and clean — slug falls free in die . . . you just tip it out. Sets in leather rolls; larger punches individually packaged.



GREENLEE
TOOLS FOR CRAFTSMEN

GREENLEE TOOL CO.
1798 Columbia Avenue, Rockford, Illinois



Cable Trough (34)

New built-in end drop-out fitting eliminates field cutting and assembling of dropout. Permits cable to drop out in orderly manner and prevents bunching. Furnished either right-hand or left-hand. Also available are built-in adjustable straight and diagonal drop-outs for center of runs.

P-W Industries, Inc., Duncan & Melrose Sts., Philadelphia 24, Pa.

Lighting Units (35)

A versatile line of high bay lighting fixtures, for incandescent and mercury vapor lamps, consisting of totally direct and up-light types in both aluminum and white porcelain enamel. Totally direct types are equipped with the new SuperLok socket head assembly which permits easy removal of reflector for servicing.

Steber Manufacturing Co., Broadview, Ill.

Labeler (36)

Embossed labels can now be made "on-the-spot" with Midgie Labeler and Tapes. A wide variety of half-inch wide tapes are available—vinyl plastic, aluminum, Monel, copper, stainless steel, zinc, lead, etc. Label has pressure-sensitive adhesive backing.

Dymo Corp., 2546 10th Street, Berkeley, Calif.

Fastener (37)

A new fastener, called Skrew-Set, is designed to fasten light-gauge metal. The multi-purpose tool is a combination hammer-in tool and drill holder. The point of tool is driven through the material to be fastened; the fastener is tightened by turning the tool. A special adapter, to hold Skrew-Set, has been developed for the Shure-Set multi-purpose tool.

Ramset Fastening System, Olin Mathieson Chemical Corp., Cleveland, Ohio.

Motors (38)

Drip-proof electric motors of sleeve bearing design (Type G) in NEMA frame series 180 and 210 are now available. Motors are recommended where quiet operation is desirable and vibration sometimes associated with ball bearings is to be avoided. Typical applications include fan drives for heating, ventilating and air conditioning equipment. They are also designed for use in connection with polishing and finishing machines where vibration must be held to a minimum. Standard motor ratings from ½ to 7½ hp are available.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Conduit Straps (39)

Snap-on steel straps for rigid conduit and thinwall conduit are designed to speed and facilitate installation of conduit. Straps will snap on conduit and remain in place while installer aligns conduit and drills bolt holes in support structure. Snap-on straps are available for ½ through 1½ in. rigid conduit and ½ through 1¼-in. thinwall.

Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

Lighting Unit (40)

A heavy-duty outdoor luminaire, No. 440, with a one-piece prismatic refractor made of thermal shock-resisting glass, designed for use with 400-watt mercury vapor or 500-watt incandescent lamps. Overall dimensions are 16½ ins. dia. and 15½ in. in depth. Mechanical holding device supports glass member by means of stainless steel spring hinge; pressure latches hold refractor assembly against gasketed hook keeping interior of unit weather-tight and free of dirt. Luminaire can be installed on cast aluminum bracket No. 0877 or standard pole bracket arm.

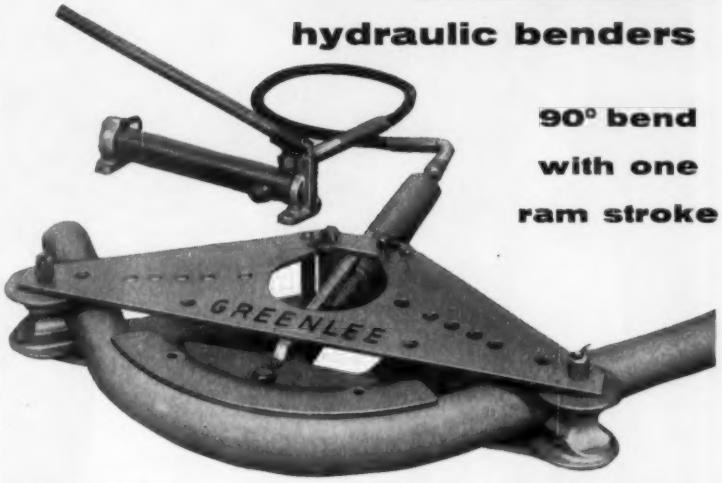
Holophane Company, Inc., 342 Madison Ave., New York 17, N. Y.

Choose from the GREENLEE

COMPLETE LINE

of fast LIGHTWEIGHT

hydraulic benders

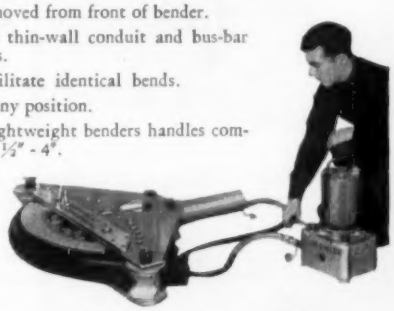


90° bend with one ram stroke

NEW No. 883 for 1/2"—3" pipe and rigid conduit.

Completes the GREENLEE unique line of fast, convenient, lightweight hydraulic benders. Makes quick, smooth, accurate bends of any size up to 90° with one ram stroke. Operates with GREENLEE No. 798 Power Pump or No. 768-M4 Hand Pump. Easily wheeled from job to job on pipe supports specially designed to serve as rollers. Has all these advantages in common with the other GREENLEE lightweight benders:

- High-strength aluminum and steel construction for minimum weight, maximum strength.
- Any bend up to 90° made quickly with the GREENLEE Hand Pumps . . . *in seconds* with the GREENLEE Power Pumps.
- Easily portable by one man.
- Fast one-man setup — rotating universal pipe supports with quick-change removable pipe support pins.
- Conduit or pipe inserted and removed from front of bender.
- Ram fits GREENLEE thin-wall conduit and bus-bar bending attachments.
- Built-in gauges facilitate identical bends.
- Benders operate in any position.
- GREENLEE line of lightweight benders handles complete range of sizes, ½" - 4".

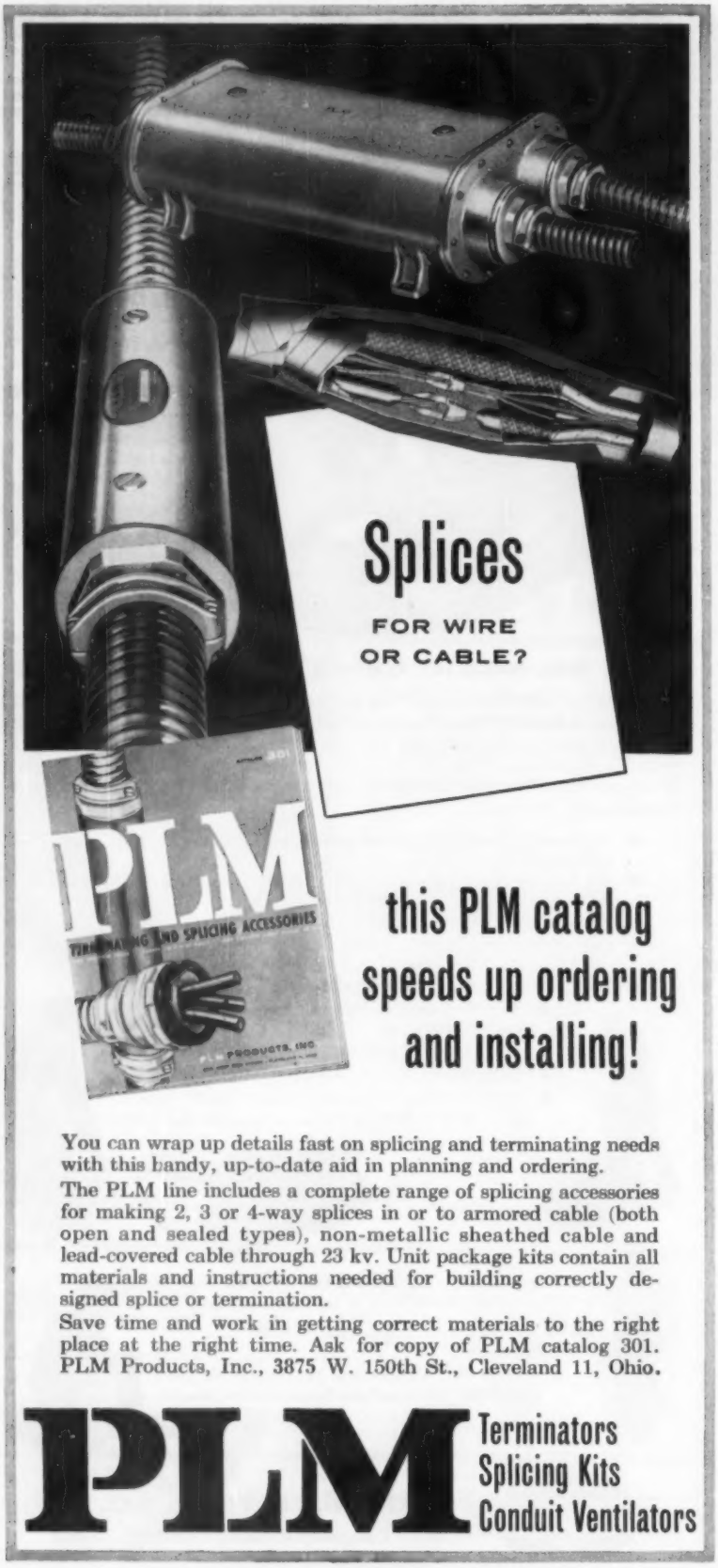


No. 884
For sizes ½" - 4". Operates with GREENLEE No. 798 or No. 797 Power Pump or No. 726 Hand Pump.

No. 880
For sizes ½" - 2". Operates with No. 768-M4 Hand Pump or No. 798 Power Pump. Easily carried by one man.

GREENLEE — TOOLS FOR CRAFTSMEN

GREENLEE TOOL CO.
1797 Columbia Avenue, Rockford, Illinois



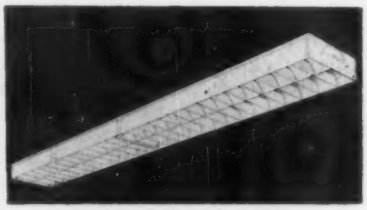
this PLM catalog speeds up ordering and installing!

You can wrap up details fast on splicing and terminating needs with this handy, up-to-date aid in planning and ordering.

The PLM line includes a complete range of splicing accessories for making 2, 3 or 4-way splices in or to armored cable (both open and sealed types), non-metallic sheathed cable and lead-covered cable through 23 kv. Unit package kits contain all materials and instructions needed for building correctly designed splice or termination.

Save time and work in getting correct materials to the right place at the right time. Ask for copy of PLM catalog 301. PLM Products, Inc., 3875 W. 150th St., Cleveland 11, Ohio.

PLM Terminators
Splicing Kits
Conduit Ventilators



Fluorescent Unit (41)

A new series of "Meteor" fluorescent luminaires designed for surface or pendant mounting. Units are 4½ ins. deep. Projection welded louvers, hinged on aluminum pins, can be lowered from either side. Louver shielding is available 35° by 25°, 35° by 45°, 45° by 45°. Louvers are self-aligning for individual or continuous run mounting. Units have side shielding or metal or heavy ribbed plastic. Units are available in 2- and 4-lamp slimline or rapid start, in 4-, 6- and 8-ft lengths.

Metalcraft Products Co., Inc., Philadelphia 33, Pa.

Wiring Trough (42)

New "JIC" enclosed wiring troughs designed to provide complete protection for wiring. The liquid-tight troughs are recommended for installation of electrical wiring on machinery, in buildings and outdoors. Made of heavy code gauge sheet steel, they are available in four standard sizes—2½- by 2½-in., 4- by 4-in., 6- by 6-in. and 8- by 8-in.—in lengths from 1 to 6 ft. Standard finish is a corrosion-resistant gray baked enamel.

Keystone Mfg. Co., 23328 Sherwood Rd., Warren, Mich.

Metal Framing System (43)

A new system for installing fluorescent lighting fixtures has been developed. The method, which utilizes the company's metal channel, provides a hanger assembly for either continuous fixture runs or spaced fixtures. A metal channel, containing a continuous open slot down the middle of one side, is attached to the fixture with a choice of adjustable hanger fittings. Stems may be attached to fitting at any point along the continuous channel. Stems may be placed up to 20 ft apart. Where used only as fixture supports, channels are installed with open slot facing down. If additional circuits are to be run through the channel, it is installed with the slot opening facing up to permit installation of wires. Channels

are produced in a number of designs in 12, 14, and 16 gauge steel, and in two lengths—10 ft and 20 ft. A variety of support fittings are available. Literature is available.

Unistrut Products Co., 933 W. Washington Blvd., Chicago 7, Ill.

Receptacle (44)

A new, fully insulated hi-impact plastic panel receptacle. Because receptacle is self-contained and self-insulated, it can be mounted, without further insulation, directly on electrical distribution cubicles, switchgear, junction boxes, bus duct, wireway or any electrical panel, to produce a "dead front" connection. Cam-Lok receptacle, with its mating plug, affords a rapid means for connecting and disconnecting power cables. Recessed copper-in-plastic design also incorporates a positive locking connection with a high pressure contact. They are made to accommodate all cable sizes from No. 16 to 4/0.

Cam-Lok Div., Empire Products, Inc., P. O. Box 98, Cincinnati 36, Ohio

Lamp Holder (45)

A new line of bell holders equipped with all-weather seals of high-temperature silicone rubber that hug lamps in a cushiony grip to help protect against vibration, pole-whip or shock. Features are an advanced "shield" design that eliminates back and side halo-light and pre-aiming quadrant that permits on-the-ground focusing. Complete aluminum line includes floodlights for medium and mogul base reflector lamps up to 500 watts as well as a special heavy-duty vapor-tight unit. Holders can be used singly or grouped in clusters for wide area floodlighting when combined with any of the variety of accessory fittings available for pole-top, mid-pole, wall or cross-arm mounting. Bulletin P-109 is available.

Stonco Electric Products Co., Kenilworth, N. J.

WHY

settle for an ordinary voltage tester?

Ask yourself these questions	The AMPROBE Junior	ordinary voltage tester
Does it measure current as well as voltage?	YES	NO
Does it give you full visibility on a graduated reading scale?	YES	NO
Does it fit conveniently in your pocket?	YES	YES
Does it measure within ±3% accuracy?	YES	NO
Does it come in a full line of models to meet different problems?	YES	NO
Does it protect you against shorts and shocks?	YES	YES
Does it balance loads, locate grounds, determine motor overloads, check rating of circuit breakers?	YES	NO

The AMPROBE Jr. gives you so much more... not just a run-of-the-mill voltage tester but a precision-made instrument that measures voltage *and* current instantly and accurately without shutting down equipment. All this with one rugged and inexpensive pocket-size tool! And now...FOR THE FIRST TIME...at the request of utilities, industrial plants and other large-scale users of AMPROBES, the AMPROBE Jr. has gone SAFETY YELLOW to conform with standard safety practices.

PICK THE AMPROBE YOU NEED! There's an Amprobe for every job, every budget: from 10 amps and 250 volts to 1200 amps and 600 volts AC; from $19.85 to $67.50. And with the Amprobe RS-3, you get a volt-amp-*ohmmeter* all in one pocket-sized, snap-around precision instrument. Every Amprobe comes with test leads; most with top grain cowhide leather case at no extra cost. See the complete Amprobe line at your jobber's today.

Amprobe Jr.®
snap-around volt-amp tester
$19.85

PYRAMID INSTRUMENT CORP., Lynbrook, New York

Specify FURNAS

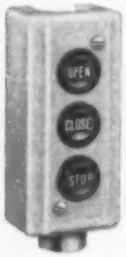
for QUALITY CONTROLS,
RUGGED PERFORMANCE
REDUCED MAINTENANCE

MAGNETIC STARTERS

Furnas Magnetic Starters, ruggedly designed to provide complete satisfaction, are available through Size 4, in a choice of 9 starters instead of the usual 5. They match the applications from 1 to 100 hp. All are UL listed, and all have dual voltage coils at no extra cost.

DRUM CONTROLLERS

Drum Controllers are available in over 1000 models. Their durability, ease of operation, versatility, and low cost make them adaptable to applications satisfied by manual control. Furnas Electric exclusively offers the Drum Control with built-in thermal overload.



PUSH BUTTONS

Push Buttons for every need—Standard, Heavy-duty, and Oil Tight. Attractive appearance and mounting flexibility assure acceptance. Furnas standardization and interchangeability mean more variations with fewer parts. Complete accessory line.

FOOT SWITCHES

MASTER SWITCHES

LIMIT SWITCHES

PRESSURE SWITCHES

Write today for free Catalog 5800, giving complete Motor Control information. 1067 McKee Street, Batavia, Illinois.

A54

FURNAS ELECTRIC COMPANY
BATAVIA, ILLINOIS
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

Distribution Systems (46)

A "new look" for distribution systems and for transformers being used with underground systems. Two designs—a pad-mounted transformer and a transformer enclosure—have been developed. Pad-mounted transformers are available in single-phase units rated 25, 37½, 50, 75, 100, and 167 kva, 2400/4160Y through 7200/12470Y volts, or in 3-phase units rated 75, 112½, 150, 225, 300, and 500 kva, 2400 through 12000 volts. Transformer enclosures are offered in two voltage classes—5 kv and 15 kv—to house conventional pole-type, single-phase transformers rated through 50 kva. In addition, the enclosures can accommodate secondary bus, arresters, cutouts, reclosers, meters or combinations of these equipments.

Line Material Industries, McGraw-Edison Company, Milwaukee 1, Wis.

Time Switch Housing (47)

A new type of case, called the "Quick-out", has been designed as standard housing for all Tork time switches. Entire time switch mechanism snaps-in or snaps-out of the case at a finger-touch. Newly-designed case opens from its center hinge, providing full access to time switch. This permits easy resetting of schedules on dial, and also allows for wiring connections or changes. Case has side, bottom and back knockouts.

Tork Time Controls, Inc., Mount Vernon, N. Y.

Flexible Conduit (48)

New Liquatite Type L.A. with a continuous copper wire in the core carries UL approval as required in various code specified installations. Types H.T. and L.T. both meet JIC specifications, the former designed to withstand temperatures as high as 220°F, the latter intended for general duty normal usage. Conduit is made from heavy, spirally-wound, square-locked galvanized metal and is either cord or wire packed for consistent bending diameters.

Electri-Flex Company, P. O. Box 128, Roselle, Ill.

V-belt Drives (49)

A new line of V-belt drives, featuring smaller and lighter sheaves and V-belts of higher capacity. Called Dyna-V, the line of drives

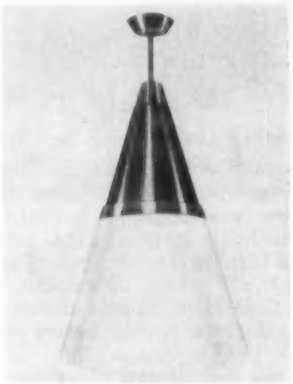
covers the complete range of horsepower capacities available in conventional drives. Drives are offered in two standard groove sizes. Besides the ⅜-in. size, known as 3V, a 5V, or ½-in. size for higher horsepowers is made. Sheaves in the 3V series, from one to 10 grooves, are designed for drives ranging from one to 50 hp. The 5V series will include sheaves to take from three to 10 of the ½-in. belts, and will handle drives up to 200 hp. Bulletin is available.

Dodge Manufacturing Corp., Mishawaka, Ind.

Lighting Fixtures (50)

Type MDS lighting fixtures are designed for interior lighting of buildings having high ceilings, such as industrial areas, armories, and gymnasiums. High-bay units are available for 300-1500-watt incandescent or 400-watt mercury lamps. Fixtures may be ordered with separable or single piece head, and with wide angle reflector suitable for low and medium mounting heights, or with concentrating reflector for high mounting and narrow areas.

Crouse-Hinds Company, Syracuse 1, N. Y.



Incandescent Unit (51)

A new cone-shaped commercial incandescent unit, called Lumicone, is a combination of spun aluminum housing and translucent Fiberglas shade. Housing is perforated in a design and finished in natural metallic silver. It can be installed to relight existing structures, without ceiling alterations. Unit is designed for a 500-watt and 750-watt R-52 reflector lamp and is available in three models for surface, pendant and semi-recessed mounting. Bulletin LC-5 is available.

Pittsburgh Reflector Co., 410 Oliver Blvd., Pittsburgh 22, Pa.

ONLY RAMSET

has the versatility to streamline your fastening jobs

Only Ramset offers a selection of over 100 powder-driven fasteners and studs . . . your guarantee that you can cover a wide range of fastening to steel and concrete with exactly the right fastener for each job.

Ramset selectivity assures the greatest possible economy and efficiency in powder-actuated fastening . . . prevents makeshift substitution of more expensive fasteners where less expensive fasteners will do the job just as well.

Ramset is the best-known and most widely used system in the world. See how it can serve and save for you with quick, permanent, streamlined fastening. Look under "Tools" in the Yellow Pages or write to us direct.

In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Set hammer-in tools for light fastening, and Ringblaster heavy-duty kiln gun.

Ramset® Fastening System

WINCHESTER-WESTERN DIVISION • OLIN-MATHIESON CHEMICAL CORPORATION
BEREA ROAD • CLEVELAND, OHIO

Transformers (52)

Small transformers simplify industrial-plant distribution system. Units convert, on the spot, 220 or 440 voltage wherever 110-volt work lights or small power hand tools are needed. Known as the Mullenbach P/S/P (power stepdown package), the unit can be bolted directly to machine tools and other equipment operating on the higher voltages. Unit consists of a rectangular steel box measuring 10- by 6- by 5 ins. connected by a short conduit to the terminals of the machine-tool line start. Unit comes equipped with a circuit breaker on the 110-volt circuit, plus a standard 3-prong receptacle. Transformer is protected on the secondary side by a single pole, fully magnetic heavy duty circuit breaker rated 1.5 amps, 110 volts. Latter also serves as a switch. Outlet is a 3-wire grounding type receptacle, rated 15 amps at 125 volts.

Mullenbach Division of Electric Machinery Co., Los Angeles, Calif.

Cable Reel (53)

Heavily loaded cable reels are easily raised and positioned for cable pay-out with portable Reelift. Device, using ordinary on-the-site conduit to extend lifting leverage, permits one workman to lift an 1152 lb. reel. Adjustable to various reel diameters, the Reelift has an all-welded base of reinforced angle-iron and measures 3 ft by 2 ft. It accommodates reels with damaged or broken flanges and does not require jacks or accessory equipment. Reelift handles up to 48 in. diameter reels. All surfaces are weather- and rust-protected.

Hykon Manufacturing Co., P. O. Box 923, Alliance, Ohio

Electric Plants (54)

Two new high frequency electric plants are Model 2.5MV55, a 2500-watt, 180-cycle, 3-phase, 230-volt, ac, 115-volt dc and Model 2.5MV35, a 2500-watt, 180-cycle, 3-phase, 115-volt ac, 115-volt dc. The 180 cycle electric plant can accommodate all of the commonly used portable electric tools at construction sites. Contractors can operate vibrators, pavement breakers, electric saws requiring 230-volt, 3-phase, ac, 180-cycle current, simultaneously with standard portable electric tools and floodlighting operating on 115-volt dc. Small concrete vibrators and high cycle portable electric tools can be operated by the 115-volt, 3-phase, ac and 115-volt dc model. Both models include recoil starter, 2-gal fuel tank, mechanical fuel pump with fuel filter and shut-off valve, oil bath air cleaners, vibro mounts, two twist-lock ac 4-prong receptacles and one twist-tite dc 2-prong receptacle.

Kohler Co., Kohler, Wis.

Time Switch (55)

A new line of heavy duty time switches, designed for high amperage loads. Known as the Intermatic "55" Series T500-R, they are recommended for controlling store window lighting, neon signs, used car lots, factories, parking lots and garages. Available in 125- or 250-volt models, the Series are rated at 55 amps per pole. They will handle up to 27,500 watts of tungsten filament lamp loads, or motor loads up to 2 hp. Up to 12 "on-off" operations a day can be obtained by use of trippers. Models are available for standard "on-off" operation, or with "Skipper" feature to eliminate operation on selected days. Bulletin NR-228 is available.

International Register Co., 2624 W. Washington Blvd., Chicago 12, Ill.

Motors (56)

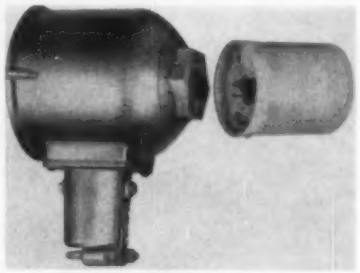
New Type EX explosion-proof motors are UL approved for Class I Group D and Class II Groups F and G service and are now supplied in new NEMA standard frames, Nos. 182 through 326U. NEMA frame assignments accommodate standard ratings of 1 through 40 hp, either 3- or 2-phase, in all commercial frequencies and voltages below 600. A specially designed external fan forces air over the outside of motor to provide constant cooling and a self-cleaning action.

Lima Electric Motor Company, Inc., Lima, Ohio

Electric Heater (57)

A new commercial and industrial electric heater, known as the C and I model. Adjustable deflectors permit directing the fan driven heat where desired, and a fan delay switch prevents heater from blowing cool air during initial operation. Plug-in operation is permitted since heater has a built-in thermostat making control wiring unnecessary. They are also made in non-automatic models. Available in two capacities: the 5 kw with an output of 17,075 Btu, and the 10 kw with an output of 34,150 Btu. The 5 kw model is portable or may be suspended on swivel-type brackets. The 10 kw model is basically two 5 kw units fixed side by side, each retaining its thermostatic control. By setting one thermostat higher than the other on this model, only half the unit need be placed in operation, drawing a lower current load.

Electromode Div. of Commercial Controls Corp., Rochester 3, N. Y.

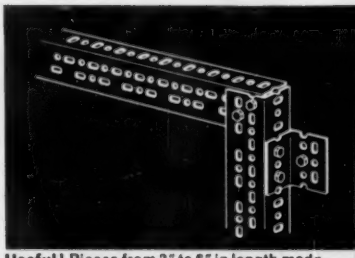


Lighting Units (58)

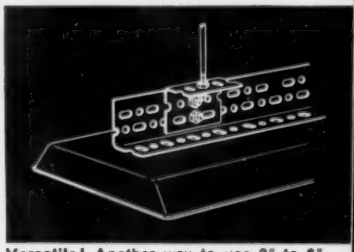
Modification in the Star-Lux and Urban-Lite street lighting luminaires permits them to be controlled individually through the use of plug-in photoelectric control units. They are wired to accommodate light sensitive controls of standard manufacture having 3-wire polarized locking plugs. The photoelectric control unit plugs into the top of the side-mounting Star-Lux head and into the socket housing cover of the Urban-Lite. It is factory-adjusted to turn on at 1.0 fc and off at 2.0 to 3.0 fc and has a screw adjustment in the range from 0.5 to 6.0 fc and a time delay circuit to prevent false operation from passing lights or lightning flashes. In addition to its new photo-electric control provision, the Star-Lux is available with a built-in ballast which permits the use of the 100-watt L-H4 and 175-watt H22 mercury lamps without the use of external ballasts.

Revere Electric Manufacturing Co., 7420 Lehigh, Chicago 48, Ill.

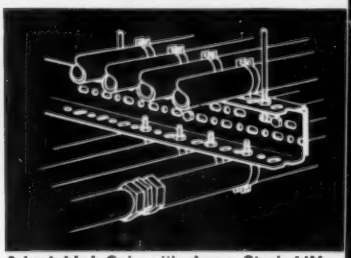
NEW AIM® BRAND SLOTTED ANGLE



Useful! Pieces from 3" to 6" in length made from end cut-offs can be bolted against a wall and used as mountings for frames built from AIM Brand Slotted Angle.



Versatile! Another way to use 3" to 6" lengths of AIM Brand Slotted Angle is to bolt to fluorescent fixture support, making it easier and simpler to level entire fixture.



Adaptable! Only with Acme Steel AIM Brand Slotted Angle is a trapeze support for conduit made so simply. A single, short section of slotted angle is bolted to ceiling rods. Conduits are attached to the support with hangers. Another length of slotted angle bolted to the first allows running conduit underneath as well.

cuts job costs up to 40%

Now, save on initial cost of installation material. Save handling when sizing or cutting. Save on-the-job fabrication time. With these savings you can cut job costs up to 40% on every electrical installation.

Versatile, adaptable AIM Brand Slotted Angle can be used as framing, supports, mountings or in countless other ways. The recurring pattern of slots and holes is precisely engineered to allow easy, convenient structural assembly or apparatus attachment. All standard electrical fittings adapt to ⅜" holes. And ⅜" AIM Brand structural bolts, with full-load shoulders, have 2000 pound safe-load capacity. AIM Brand Slotted Angle is cold-rolled for maximum strength, galvanized for rust resistance. Two sizes: Standard, 2¼" x 1½" x .080" and Heavy-duty, 3" x 1½" x .104".

Only two tools needed to work it on-the-job: AIM Brand Cutter and a hand or power wrench. Easy to handle, store or inventory. New AIM Brand Slotted Angle is available nationally. Get it through your local distributor.

For a FREE book about AIM Brand Slotted Angle, write Dept. EBD-19, Fabricated Materials Division, Acme Steel Company, Chicago 27, Illinois. This booklet shows the many ways you can use this new material and tells about all its advantages.

ACME STEEL **AIM Brand Slotted Angle** AIM® BRAND

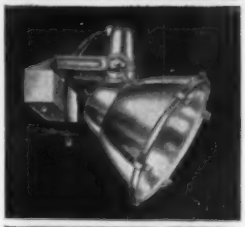
Floodlights by Revere for every outdoor job

Revere Electric Manufacturing Co. produces a broad line of lighting equipment which includes a high quality floodlight for virtually any outdoor lighting application.

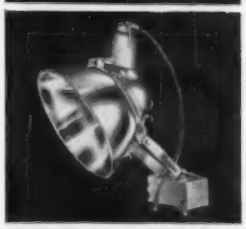
Revere floodlights are precision-engineered to achieve highest output combined with uniform light coverage. Dependable, easy-to-install Revere Floods are specially designed for easy re-lamping and cleaning. You can depend on Revere's long experience and sound engineering to solve your particular outdoor lighting problem.

Low cost, broad coverage 22-inch Eliptor floodlight is made of vitreous-fired porcelain enameled steel with choice of colors, or aluminum. Enameled steel model available with or without Alzak finished aluminum reflector. Inside of aluminum model has Alzak finish for best light projection. Wide range adjustments provide for accurate settings. Use 300 to 1500-watt incandescent or 400-watt mercury lamps. 3800 Series.

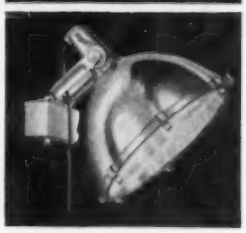
Small size aluminum floodlight, 12, 14 or 16-inch, is available either open or enclosed with clamp or hinge-type cover. Reflector is spun aluminum with etched Alzak finish for wide beam, polished Alzak for narrow beam. Housing is cast aluminum. Use incandescent lamps from 200 to 1000 watts. 7100 Series.



High power general purpose 18-inch floodlight for large areas. Wide or narrow beam Alzak aluminum reflectors. Hinged cover clamps to reflector for tight seal. 18-inch heat resisting lens available in plain, stippled or ribbed glass. Swing-over feature allows easy maintenance. Use 750, 1000 or 1500-watt incandescent or 400-watt mercury lamp. 4200 Series.



High power, rear service 18 or 20-inch floodlight has hinged rear reflector opening for safe, easy cleaning and relamping. Reflectors have Alzak specular or Alzak diffuse finish for narrow or wide beam. Front and rear sights enable accurate aiming of beam. Use 750, 1000 or 1500-watt incandescent lamps. 2000 Series.



Exceptionally high output 24-inch mercury floodlight for shopping centers, parking lots and other large areas. Alzak specular finish reflector for wide beam. Available with clamp or hinge-type lens holder with impact resisting lens. Fixture is weather-proof. Use 1000-watt 52,000 lumen mercury lamps. 7400 Series.

Send for Revere's complete catalog of outdoor lighting equipment

Revere ELECTRIC MFG. CO. **OUTDOOR LIGHTING**

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
Long Distance Phone: NIles 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles

Catalogs & Bulletins

(59) LIGHTING FIXTURES. 4-page Folio No. 588 describes custom linear lighting, picturing suggested configurations for ceiling or wall installation. Artcraft Lighting Co.

(60) AIR CONDITIONERS. 12-page bulletin 9327 describes new line of basic vertical and horizontal units, free-standing enclosures, and individual room units with complete specifications. American Standard, American Blower Div.

(61) CEILING LIGHTING SYSTEMS. 6-page folders on each of three new systems include information on important features, mounting details, shielding, and dimensions. Smithcraft Lighting.

(62) SERVO SYSTEM components. Four new bulletins describe new line of electrohydraulic units for fluid power systems, including valves, power amplifiers, preset units, and panels. The Oilgear Co.

(63) WIRING DEVICE reference manual, 144 pages, describes complete line, as well as new stock products such as wall plates and other devices in decorator colors, marked wall plates, and glow-in-the-dark mercury switches. Catalog 100. Sierra Electric Corp.

(64) SUBMERSIBLE MOTORS. Bulletin GEA-6853, 6 pages, describes design and performance features of oil-filled motor for 4-in. well applications. General Electric Co.

(65) LIMIT SWITCHES. Catalog 84, 16 pages, covers complete line of heavy duty switches in variety of contact arrangements, either ac or dc. Micro Switch.

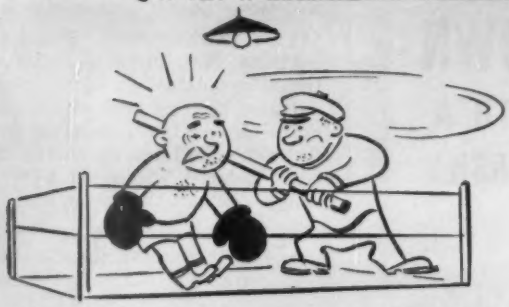
(66) SWITCHGEAR. 24-page bulletin 2804-1A describes 4160-volt metal-clad switchgear with ratings through 3000 amps, 350-mva interrupting capacities. I-T-E Circuit Breaker Co.

(67) GYMNASIUM LIGHTS. 4-page catalog describes new line using either two 96-in. Power Groove rapid-start lamps or two or three 48-in. or 96-in. rapid start or slimline lamps for stem, chain or surface mounting. All-Brite Fluorescent Fixtures, Inc.

(68) MOLDED-CASE BREAKERS. Bulletin 5004-1A presents construction and performance features, ratings and details of circuit breakers with ratings 10 through 800 amps. I-T-E Circuit Breaker Co.

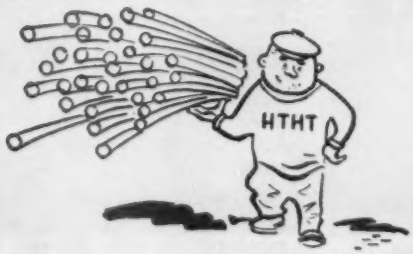
Naugatuck KRALASTIC

Lightweight with heavyweight stamina



Kralastic® Plastic Pipe is impact-resistant. It resists damage from tools, rocks, and the roughest of handling. It's so tough you not only can slug somebody with it—you can actually drive a nail with it.

Kralastic is a favorite where chemicals have to be handled. It handles corrosive liquids in chemical, paper, food-processing and water-treatment plants.



Light in weight, Kralastic is ideal for conduits for electrical wiring (same weight, more wires). Widely used for transporting potable water (N.S.F. approved).

Economical Kralastic stays economical because it lasts so long, is so easily and quickly installed. Make sure the plastic pipe you buy for high-pressure or high-temperature service is made of Kralastic HTHT—for your satisfaction.

Kralastic is the tough rubber-resin material (one of the first to produce plastic pipe) that has proved itself not only in natural gas lines, oil field pipe, and valves of any kind, but in hundreds of other tough applications, including water transmission lines.

Investigate Kralastic Pipe and learn more of its many advantages. For detailed particulars, write today to the address below.

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United States Rubber

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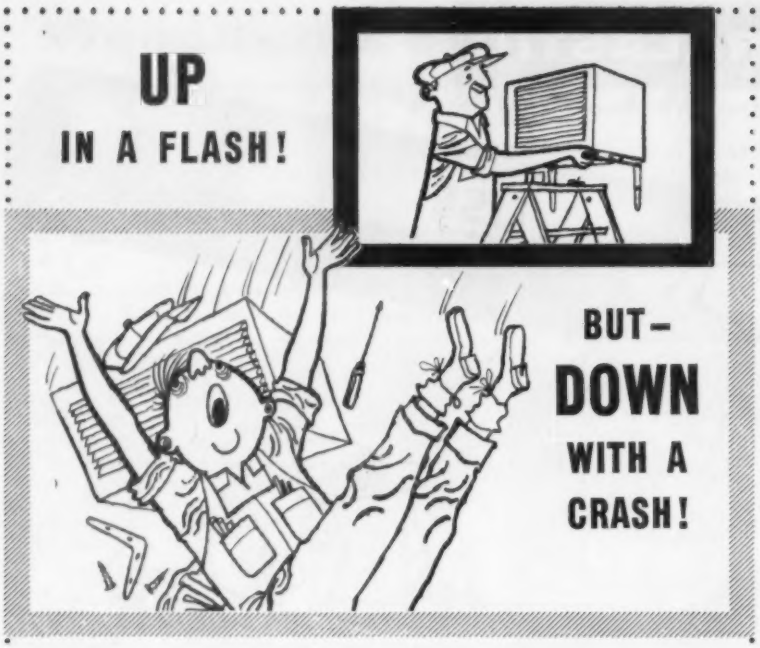


Beware of inferior screw anchors

INSIST ON BRANDED RAWLPLUGS

Whenever you fasten fixtures to plaster, brick, construction block, or concrete, use time-tested Rawlplugs to put work up fast, put it up to last. Now they're branded with the name "**RAWL**"... look for it to make sure you get genuine Rawlplugs.

Your **RAWL** distributor has a complete stock of Rawlplugs, hand or power Rawldrills for masonry drilling, and a full line of other masonry anchoring products. To help you select the right masonry anchor for your job, he'll gladly give you your complimentary copy of the "Masonry Anchoring Handbook." Ask him for it or write us . . . it's **free.**

R-1

THE **RAWLPLUG** COMPANY, INC.

212 Petersville Road, New Rochelle, N. Y.

(69) EMERGENCY LIGHTS. New line of battery-powered, portable or fixed emergency lighting is described in new catalog 100, including sealed-beam spotlights, searchlights, flashing warning signal lights, lantern-type lights, vehicle beacons and flashers. K-S Marine Products, Inc.

(70) AUTOMATIC CONTROL SYSTEMS for heating, ventilating and air conditioning installations. Bulletin F-8944 analyzes application, advantages, types of systems, and selection. Barber-Colman Co.

(71) SURGICAL LIGHT. Bulletin 68 contains descriptive material and technical data on new track-mounted lighting unit which beams light from four separate prefocused reflectors, producing constant pattern within 30 to 60-in. range. Wilmot Castle Co.

(72) MOBILE SUBSTATIONS in ratings through 10,000 kva, 69 kv and below, are described in new bulletin 61B9060. Allis-Chalmers.

(73) INDUSTRIAL LIGHTING. 8-page bulletin (File 4, Folder 2) gives complete specifications on new Kolordoded Wyteliner industrials with standard, HO, Power Groove, VHO or SHO lamps. Colored markings on reflectors help identify aisles, hazard areas, exits, etc. Edwin F. Guth Co.

(74) ELECTRIC HEATERS. Bulletin 1101 gives specifications and construction data on fan-driven wall insert heaters for home, motel and office-type installation. Ilg Electric Ventilating Co.

(75) WALL FASTENERS, pole line hardware and masonry drills are cataloged in new 40-page booklet complete with specifications, packaging information and dealer prices. Catalog 158. Diamond Expansion Bolt Co.

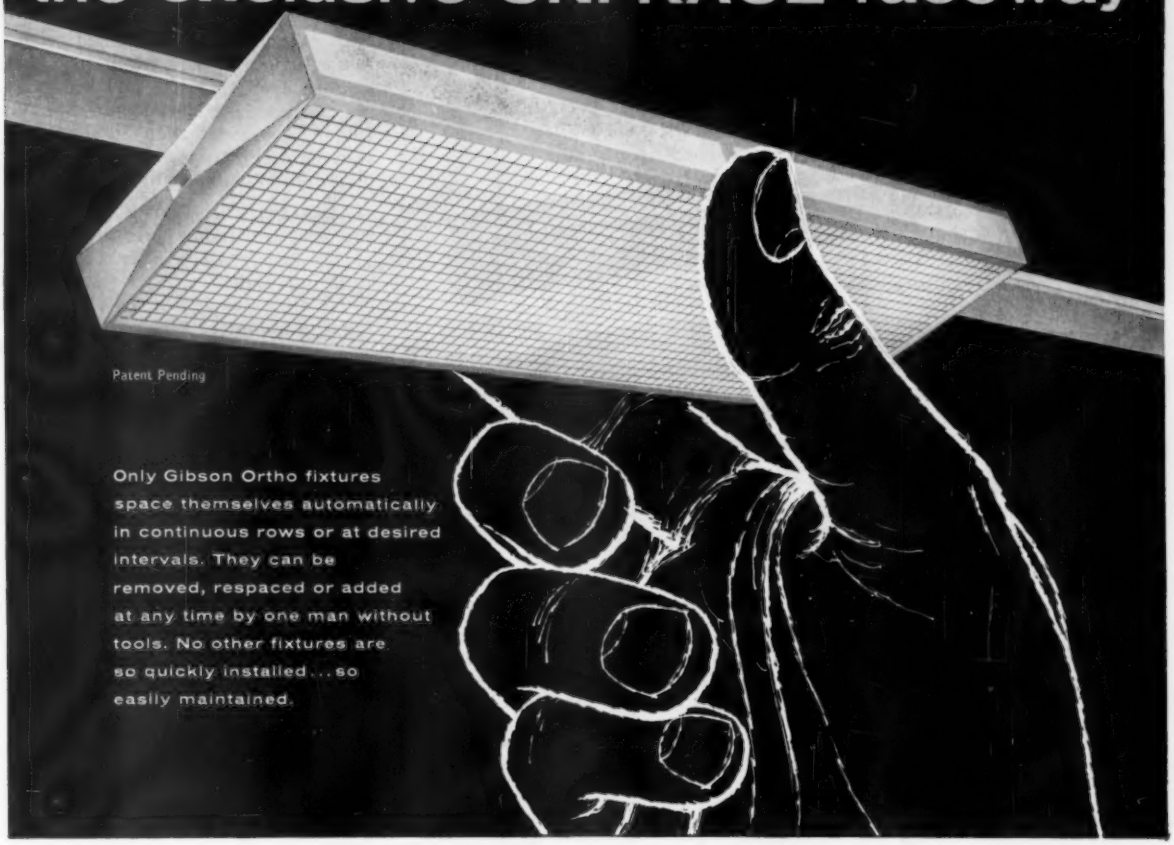
(76) INSULATING TAPES, asbestos and Fiberglas, are described in two new booklets. Included are descriptions, samples and performance characteristics of all-purpose electrical tapes which resist moisture, rot, chemicals, and high temperatures—and will not burn. Atlas Asbestos Co.

(77) UNDERFLOOR RACEWAYS. 52-page catalog updates information on complete line of underfloor distribution components, including service fittings, boxes and saddle supports. National Electric Products Corp.

(78) POWER GROOVE LIGHTING. "21 Industrial Lighting Problems Solved with Power Groove" is title

GIBSON ORTHO 66

the fixture that just plugs in on the exclusive UNI-RACE raceway

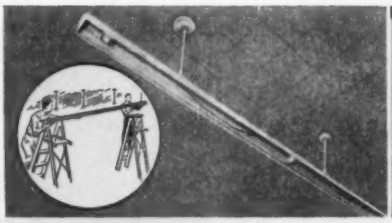


Patent Pending

Only Gibson Ortho fixtures space themselves automatically in continuous rows or at desired intervals. They can be removed, respaced or added at any time by one man without tools. No other fixtures are so quickly installed... so easily maintained.

installation quick and simple

1 Uni-Race, U.L. approved raceway of 225-amp capacity, is assembled and wired on floor.



2 Light, rigid Uni-Race assembly up to 48′ easily lifted and hung.

3 Fixtures simply snap into place. Plug in fixture engages receptacle in Uni-Race.

WRITE FOR COMPLETE INFORMATION ABOUT THE GIBSON ORTHO LINE

Gibson LIGHTING

GIBSON MANUFACTURING COMPANY

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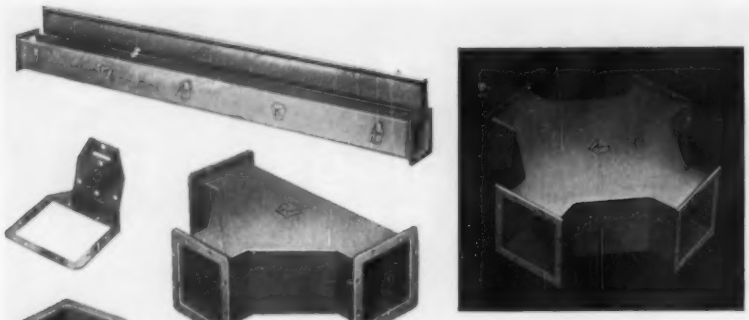
Manufactured in Canada under franchise by Electrolier Manufacturing Co., Ltd., Montreal



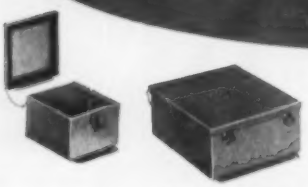
"JIC" Wireways and auxiliary fittings

"JIC" Enclosed wiring troughs

It pays to figure on

KEYSTONE

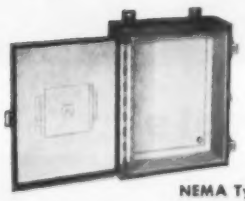
liquid-tight **"JIC" wiring enclosures**



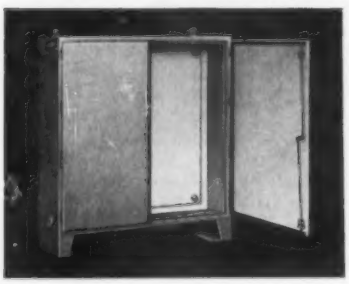
"JIC" Terminal and Pull Box Enclosures

Keystone now offers a complete line of "JIC" wiring enclosures designed to provide positive, sealed protection against dust, dirt, oil, water and coolants! You'll find liquid-tight wireways, fittings, troughs, boxes and cabinets in a wide range of sizes to meet your exact needs—all produced to the electrical specifications of the Joint Industry Conference Standards.

What's more, when you *want* an item, you *get* it—*fast*—from large stocks maintained at both factory and regional warehouses! In addition, Keystone offers a complete design and build service for producing custom enclosures to fulfill your special requirements!



NEMA Type 12—"JIC" Control Panel Enclosures



Oil-Tight Pushbutton Enclosures

3 NEW CATALOGS—Contain complete information on the entire Keystone quality line. Send for your free set today!

KEYSTONE MANUFACTURING COMPANY

23338 Sherwood Avenue • Warren, Michigan

of new publication covering case histories of complete range of industrial operations. Lighting layouts and cost data are shown for each. General Electric Co.

(79) BASEBOARD HEATER. Bulletin 1401 gives complete specifications and construction and installation data on new heater, available in 2, 5 and 8-ft lengths, 120 or 240 volts. Ilg Electric Ventilating Co.

(80) ALTERNATORS combined with new silicon rectifiers which provide infinite operating life and reduced maintenance are detailed in 4-page folder with more than 30 illustrations highlighting design and application. Leece-Neville Co.

(81) ALUMINUM APPLICATIONS in the electrical industry is the theme of the new "Alcoa Report to the Building Industry". 32-page brochure discusses economics of choosing aluminum for such applications as conduit, wire and cable, busway, enclosures and switchgear. Aluminum Co. of America.

(82) INDUSTRIAL CONTROL. 8-page bulletin 958 illustrates complete line of individual products and assembled controllers, introducing new speed-responsive switches. Euclid Electric & Mfg. Co.

(83) LIGHTING FIXTURES. 8-page catalog describes wide range of popularly priced fixtures for contractors who ordinarily consider price alone in choosing fixtures. Lightolier, Inc.

(84) METALLIC SHEATH CABLE. New catalog describes characteristics, engineering data, applications and test results of C-L-X sheathed cable. Simplex Wire & Cable Co.

(85) PHOTOELECTRIC CONTROL catalog describes controls with Cad Cell sensing element, using transistor and magnetic amplifier. Autotron, Inc.

(86) POWER SWITCHES. Bulletin PSE1 gives complete information on switches rated at 600 or 1200 amperes from 7.5 kv to 69 kv. Line Material Industries.

(87) PHASE SEQUENCE INDICATOR for rapid determination of the order in which voltage peaks of a multi-phase power supply occur are described in new bulletin 1550. Opad Electric Co.

(88) AC GENERATORS. 16-page bulletin describes complete line of brushless generators rated from 6.25 through 500 kva at various combinations of speeds and number of poles. Kato Engineering Co.

A-B Reliable Control Units

for every industrial application

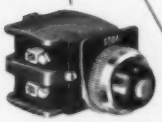
Among the many hundreds of Allen-Bradley push button and control units, you are certain to find the types best suited to your particular needs. The seven units shown below are a few of the latest additions to the Allen-Bradley *quality* line of control units.

All Allen-Bradley control units—standard duty, heavy duty, and oiltight—have double break, silver alloy contacts—to assure reliable operation. Simple constructions and generous wiring room are outstanding features. Insist on Allen-Bradley control units for *all* of your equipment—you can't go wrong!

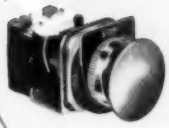
NEW

Illuminated Push Button. Combines pilot light and push button in one unit. Oiltight Bulletin 800T.

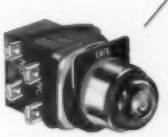
Encapsulated Pilot Light. Oiltight Bulletin 800T.



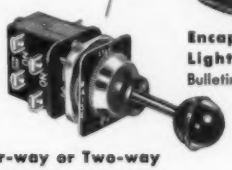
Encapsulated Pilot Light. Heavy Duty Bulletin 800.



Time Delay Push Button. Delay is adjustable from 0.5 second to 5 seconds. Oiltight Bulletin 800T.

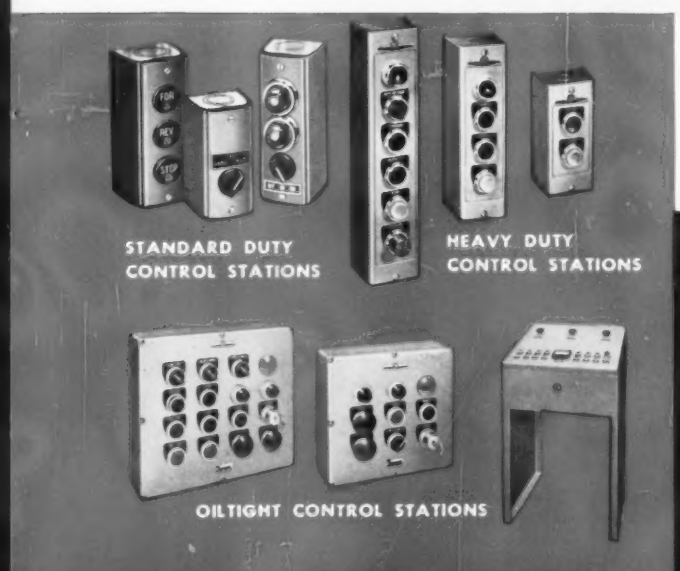


Push-to-Test Pilot Light. Oiltight Bulletin 800T.



Four-way or Two-way Selector Switch. Oiltight Bulletin 800T.

Double Circuit Push Button. Has 2 N.O. or 2 N.C. contacts. Oiltight Bulletin 800T.



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MOTOR CONTROL
QUALITY

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In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

A new "quality" standard for small REVERSING DRUM SWITCHES

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GOOD-LOOKING AND GOOD "FEELING" DIE CAST HANDLE

EASILY ACCESSIBLE MOUNTING HOLES

MERELY LOOSEN SCREW AND SLIDE PLATE to change from momentary to maintained contacts —or vice versa

INDEPENDENT SWITCH MOUNTING prevents misalignment

HEAVY CONTACT SURFACES for long operating life

TWO CONDUIT OPENINGS

WRAP-AROUND COVER gives complete access to drum

SINGLE SCREW COVER MOUNTING —screw cannot fall out

ACCESSIBLE SCREW TERMINALS for front wiring

RAISED EDGE for base mounting without spacers

maximum rating 2 horsepower

NEW OILTIGHT COVER PLATE FOR CAVITY MOUNTING

Bulletin 350 Reversing Switch can be furnished with oiltight cover plate with rubber gasket seal for cavity mounting in a machine base.

This *all-new* Allen-Bradley reversing drum switch was designed to keep pace with the mechanical beauty designed into so many of the modern machine tools.

The Bulletin 350 reversing switch is equivalent to a three-pole, double throw switch . . . and can be used with d-c motors; or single phase, two phase, or three phase a-c motors.

Investigate the Bulletin 350 . . . the *new leader* of its class . . . in appearance, ease of installation, and operating life. An Allen-Bradley *quality* switch . . . in every sense of the word. Send for descriptive bulletin.

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Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Instruments

QUESTION B35—Can a combination voltmeter and ammeter which uses one meter for all readings be used as a wattmeter by connecting voltmeter and ammeter connections at the same time in the circuit? The voltage would have a one-to-one isolating and insulating transformer between the voltage and meter. The current and voltage ratings would also be each reduced to half normal so as not to overload the meter. Only approximate readings are required.—E.B.

ANSWER TO B35—If the meter you have is of the rectifier type you are out of luck. A wattmeter has both a potential coil and a current coil with a displacement of 90°. The force of the two coils is a product of the voltage, current and power factor giving a reading of watts. In the rectifier type meter there is a magnet and a coil which receives rectified current. Applying both potential and current at the same time would give no indication of watts.

If the meter has two coils you might toggle it up to read something, but the scale would have to be recalibrated. To do this you would have to revamp the meter in order to apply current to one coil and potential to the other. You will be money ahead to buy a separate wattmeter or a combination ammeter, voltmeter and wattmeter.—W.E.G.

ANSWER TO B35—The galvanometer used in a wattmeter is always of the electrodynamic type. This type of galvanometer has a stationary or field winding and a moving coil or rotor winding. In a wattmeter, the field winding carries the current in the load while the rotor winding is usually of high resistance and placed across the load. With these connections, a wattmeter reads the power drawn by a load.

A combination or multi-meter usually uses a galvanometer of the iron vane, thermocouple, or rectifier type. These cannot be used for wattage readings because of the lack of separate windings for current and voltage. If these instruments did have separate windings, it would still be necessary for the displacement of the needle to be proportional to the product of current, voltage and power factor.

Finally, a multi-meter using any kind of galvanometer reads current by virtue of calibrated shunt resistors and voltage because of calibrated series resistors. Even if an electrodynamic galvanometer is used, its windings could not be separated by merely using current and voltage jacks available on the cover of the meter. In short, if an attempt were made to use a multimeter as a wattmeter as described in the question, it would be burned out.—I.F.

Transformer Windings

QUESTION C35—What is the significance of polarity of transformer windings; i.e., subtractive or additive, and why are not all transformers wound additive?—J.A.M.

ANSWER TO C35—The windings of a transformer are usually so connected that the leads through the case or housing are in such a manner that the flow of current or the polarity at any given instant is the same (in direction) in all corresponding leads of the transformer, both primary and secondary, as an example if the left hand primary lead (looking down on the top of transformer) was marked X1 and the right hand lead marked X2, while the left hand secondary lead was marked L1 and the right hand lead marked L2. At the instant that flow into the transformer was through X1, the flow out of the transformer would be through L1. At the same instant the flow into the secondary would be through L2 and out on the lead X2. A drawing of the two windings and their marking will illustrate this point, remembering that X is the primary and L is the secondary, and that X1 and L1 must be on the same end of transformer.

Polarity (so-called) has to do only with the arrangement for bringing out the leads, and interchanging either the primary or the secondary leads will change the so-called polarity.

The difference between additive or subtractive polarity can best be understood by considering the above. If the voltage (potential) between X1 and X2 equals 2200 volts and if the transformer is 10 to 1, then the voltage between L1 and L2 should be 220 volts. The voltmeter between X1 and X2 is called V1 and the voltmeter between L1 and L2 is called V2. Now if X1 and L1 are connected together and a voltmeter is inserted between X2 and L2, this reading for an additive transformer should be V1 plus V2 or 2420 volts, while for a subtractive transformer the reading should be V1 minus V2 or 1980 volts. This means that the windings would be subject to a strain of 2420 volts on one hand or 1980 volts on the other hand. In most cases it is an advantage to use transformers of subtractive polarity. It must be remembered that you cannot connect one additive and one subtractive transformer together, as you will then have one short-circuiting the other one.

The reason that all transformers are not additive is an engineering problem of design, and unless the primary and secondary voltages are relatively close in value it would not make much difference what polarity they were and if it were felt necessary that the polarity be changed, it could be changed very easily.—C.L.

ANSWER TO C35—Polarity markings are used to indicate the vector relation of induced voltages in the secondary winding, as compared to the primary winding of a transformer. Thus if the primary terminals are labeled H1 and H2, and the secondary terminals are labeled X1 and X2, then the induced voltage from H1 to H2 would be in phase with the induced voltage X1 to X2. This information is necessary when connecting transformers in parallel, or in 3-phase banks, or when using instrument transformers for relaying or metering purposes.

Whether a transformer has additive or subtractive polarity depends on the physical arrangement of how the coil leads are brought out of the enclosing bank. If the H1 lead is in a corresponding physical location with respect to the X1 lead, the transformer has subtractive polarity. If the H1 lead is in a

Outdoor lighting at Del Webb's HiwayHouse Hotel, Phoenix, Arizona, comes on automatically at night, goes off in the morning. Underground wiring is protected by 3200 ft. of SPANG HD Galvanized Conduit in this seven-acre patio. Hotel has 250 rooms, can accommodate 650 guests.

SPANG Conduit Protects HiwayHouse Hotel Wiring

"We want to maintain our record for quality installations," says Mr. Ernest E. Cannon. "Therefore we always use dependable, durable materials. That's one reason why we use SPANG Conduit regularly."

At the $3 million Del Webb HiwayHouse Hotel, one of Phoenix, Arizona's newest and most attractive inns, over 6,800 ft. of SPANG Galvanized Conduit serves elaborate outdoor lighting, indoor power requirements and telephone lines to all rooms.

SPANG Conduit helps maintain rush schedule

Mr. Ernest E. Cannon, owner of Cannon & Wendt Electric Company in Phoenix, says: "The contractor's schedule called for speedy construction. Because SPANG Conduit is easy to work with, there was no delay in making this installation. Bending was fast and accurate; the excellent hot-dipped galvanized finish took even the severest bends with no trouble."

Conduit serves many purposes

Buried underground, SPANG Conduit protects automatic outdoor lighting that illuminates swimming pool, trees, shrubs, parking lot, buildings and patio. Inside, all lighting, air conditioning, food preparation and phone system wiring is carried by conduit runs in ceilings and walls.

Make SPANG your first choice

It's *quality-controlled* during manufacturing, and tested and inspected to provide you with *top-quality* conduit every time. Your local SPANG Distributor carries the complete line of conduit and fittings. Let him serve you on your next job.

Architect: Victor Gruen, New York, N.Y.

General Contractor: Del E. Webb Construction Company, Phoenix, Ariz.

Electrical Contractor: Cannon & Wendt Electric Company, Phoenix, Ariz.

SPANG Distributor: Brown Wholesale Electric Company, Phoenix, Ariz.

SPANG® CONDUIT

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

ments did have separate windings, or subtractive polarity can best be tive polarity. If the H1 lead is in a

corresponding physical location with respect to the X2 lead, the transformer has additive polarity.

Almost all of the recently manufactured transformers have subtractive polarity. This is because the primary and secondary leads of a transformer having subtractive polarity would be subject to lower voltage stresses than a transformer having additive polarity. Though on transformers having low voltage ratings this is not significant, it becomes an important factor in the design of the higher voltage rated units.—L.S.

Grounded Service

QUESTION D35—In our public utility system we have several 3-phase power banks connected closed delta and open delta. Secondary voltage is 240 volts. Many of these banks never had secondary grounds at the pole or at the service entrance switch. We are considering grounding these banks at the pole. The service entrance switches which have been in for many years are 3-pole fused type with no ground. After eliminating all accidental grounds, we are considering adding a ground at the service switch and making the grounded or common line fuse solid.

What are your recommendations for a new grounded service?—D.J.D.

ANSWER TO D35—On new services, I would recommend a grounded neutral by means of a grounded wye-connected secondary, preferably, or by use of a zig-zag connected grounding transformer. Where delta-connected secondaries are used without supplementary grounding transformers, I would recommend combined lighting and power services with mid-point grounded neutral taps. As a last resort on straight 3-phase delta-connected secondaries, I would recommend "corner" grounding.

In connection with the old ungrounded services which you have recently grounded, the entire connected system should be checked for polarity so that the grounded conductor could be identified throughout and have all overcurrent and control devices removed from the grounded conductor and placed in the ungrounded conductors.—W.R.S.

ANSWER TO D35—The use of corner-of-the-delta grounding should be discouraged because of

here are 6 good reasons why you should insist on

SANGAMO

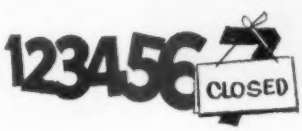
HEAVY-DUTY TIME SWITCHES

Sangamo Heavy-Duty Time Switches are rugged. They're built to withstand rough handling and to give unfailing on-off control. Rain-tight gasketed case and internal dust cover protect mechanism against adverse weather.

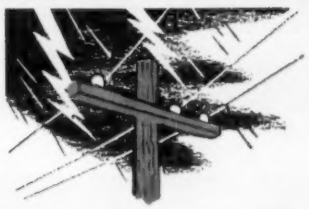
Sangamo Time Switches are precision-built. Long life, slow speed synchronous motor is quiet and specially lubricated to function perfectly in a temperature operating range from −50° to +200° F.

Sangamo Heavy-Duty Time Switches are quick and easy to install. There's plenty of inside wiring space and multiple knockouts in sides, back and bottom.

Sangamo Switches equipped with *astronomic dials* can be set to turn on at sunset and off at sunrise (or earlier) automatically—all year 'round. Dial compensates progressively day by day for season changes.



Sangamo Heavy-Duty Time Switches may be furnished with an optional *omitting device* which permits establishment of 1 to 6 day weekly operating schedules.



Sangamo Switches with *automatic carryover* do not have to be reset or rewound after a power outage. Switch keeps running and maintains its accuracy for up to 10 hours, if power fails.

Ask your Electrical Wholesaler to furnish you with all the facts on how it pays you to standardize on Sangamo Time Switches.

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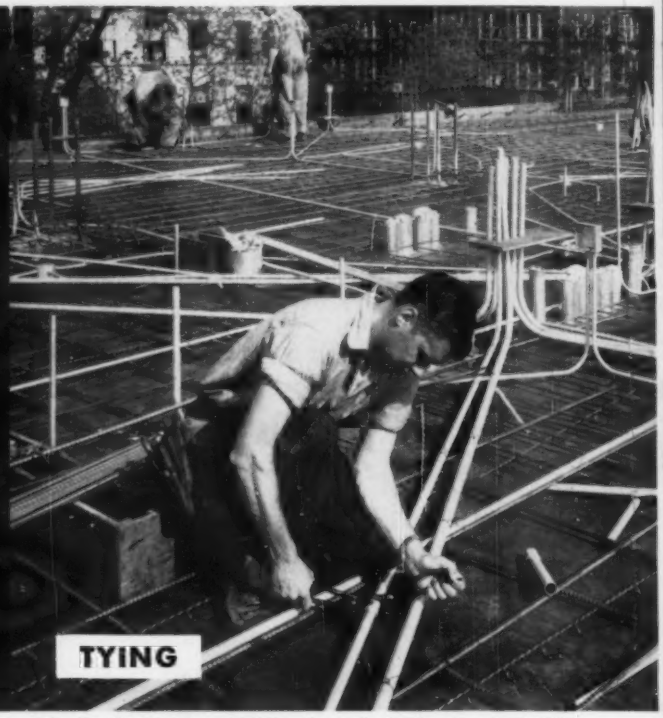


...tying Republic ELECTRUNITE E.M.T. to the reinforcing bars is good installation practice.

THE BEST

The Republic ELECTRUNITE E.M.T. installation photos, above, were taken during the construction of this attractive six-story resident students apartment building on the campus of a leading Midwest university.

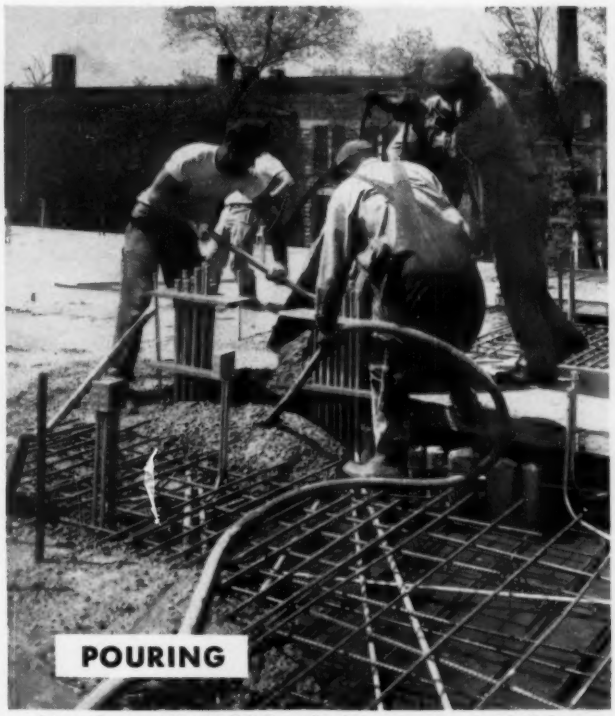
Architect: Burnham & Hammond, Chicago, Illinois
General Contractor: B. W. Handler Construction Co., Chicago, Illinois
Electrical Contractor: Gibson Electric Company, Inc., Chicago, Illinois

EXCLUSIVE "INCH-MARKS"® make quick measurement a cinch. Every length of Republic ELECTRUNITE E.M.T. is marked off in feet and inches from end to end. Eliminates guesswork, saves time, saves material, keeps the job on schedule.

"GUIDE-LINE" extends full length of tubing. By properly aligning with calibrations on Republic Bending Tool, bends are kept in the correct plane. It is easy to make true offsets, saddles, back-to-back bends to meet the job.

New, improved "INSIDE-KNURLING" with exclusive SILVERSLICK inside finish makes wire pulling up to 37% easier. Wire pushing is easier, too. Wires slip through longer runs and greater bends easier than ever before.

..."INCH-MARKS" and "GUIDE-LINES" help make neat, compact stub groupings.



...fittings fit... ELECTRUNITE E.M.T. quality helps you stay ahead of the pour.

COSTS LESS INSTALLED

In concrete installations... quality materials, craftsmanship, and good installation practices assure a good job. Republic ELECTRUNITE® E.M.T. with exclusive "INCH-MARKS", full length "GUIDE-LINES", and new, improved "INSIDE-KNURLING" with SILVERSLICK inside finish are three good reasons that prove . . . the *best* costs *less* installed! Here's why:

ELECTRUNITE's tightly adhering galvanized coating protects against corrosion. It won't chip or flake off during bending. No threading is required. Uniform concentricity assures snug fit of couplings and connectors—shutting out moisture and concrete. Proof can be found in the millions of feet of ELECTRUNITE that has been installed in concrete. Installations made more than 25 years ago are still in service.

Republic ELECTRUNITE E.M.T. is produced to ASA Specifications C80.3, Federal Specifications WW-T-806, and carries the Underwriters' Seal of Inspection. For additional information, send coupon today.

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MODEL UB

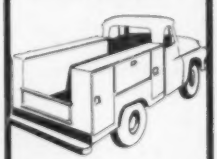
LOWEST COST · MODEL UB

CHECK THESE FEATURES THEN ...CHECK OUR LOW PRICES!

• Anti-Buckling, heavy duty corrugated or diamond plate floor with drainage outlets • Rigid front panel ribbed for stiffness • Removable dividers every 4" on tray in curb side horizontal compartment are held down with retainer to keep dividers from bouncing and causing parts to mix • 1" rolled lip provided on material shelf in left horizontal compartment • Heavy duty 12" tailgate opening to floor level • New flush pull-out type door handles with double slam action catches and master keyed cylinder locks • Handle protrudes when lock bolt is not fully engaged — warning when door not securely closed • All edges of parts hemmed for safety • Double panelled doors • Rod type hinges rolled into door hem • Doors hinged on special grease loaded bearings to prevent binding common with piano hinges • Full 48" Bed Width.

THE NEW MODEL UB SERVICE AND MAINTENANCE BODY is available to fit any ½ or ¾ ton chassis in a choice of three Compartment Layouts. The variety and flexibility of designs makes the UB UTILCO SERVICE BODY adaptable in a variety of fields including: Utilities, Plumbing, Electrical, Refrigeration, and governmental service. The Compartment interiors can be assembled to meet each customer's individual requirements. This is but one of a full and complete line of Service and Construction Bodies...write UTILITY BODY COMPANY or telephone your nearest distributor.

SERIES TC TOOL COMPARTMENTS



MODEL UB-X

SERIES U-56 CROSS COMPARTMENTS

MODEL UB-T

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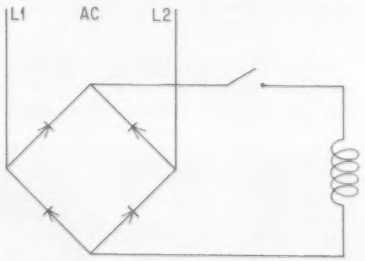
the hazardous control circuit problems that are often encountered. If the operating coil of a 3-phase magnetic starter is connected to the grounded phase, it is possible for a ground fault to occur in the control circuit and remain undetected until the "start" pushbutton is depressed, completing the phase-to-ground fault path. In this instance full fault current would flow through the pushbutton, a very hazardous condition. Other similar circumstances may cause the starter contactor to "pick-up" spontaneously on the occurrence of a ground fault without operation of the "start" button. This also would represent a considerable hazard to anyone working near the motor. To avoid these dangers on a line grounded system it would be necessary to identify the grounded phase at all points or to employ isolating control power transformers in all 3-phase starters.

For these reasons it is always more desirable to create a system neutral point by means of a grounding transformer of suitable characteristics, and then ground the system neutral accordingly. For further detailed comments and illustrations refer to "Industrial Power Systems Handbook" published by McGraw-Hill.—L.D.B.

Can You Answer These QUESTIONS

QUESTION M35—We have had to replace quite a few rectifiers for an electric brake wired as shown in the diagram. Would a discharge resis-



tor across the coil remedy our trouble, or would it be advisable to connect the switch in the ac line instead of the dc side of the rectifier as it is now?—J.J.L.

QUESTION N35—In our plant we have been conducting an electrical preventive maintenance program involving periodic inspection and regular overhaul of equipment.

A critical look is being taken at our maintenance costs and we are questioning the economics of our

program. No doubt there is a point of diminishing returns in any preventive maintenance program or a large part of it could be eliminated and it would be more economical to operate equipment to failure before repairs are made.

I would appreciate hearing opinions from your readers on this subject.—R.E.B.

QUESTION P35—In designing industrial plant electrical systems, I have several times encountered exhaust fans with motors of 5 hp or more in drafting rooms and office areas, with the only nearby panel being a 120/208-volt, 3-phase lighting panel.

Is there any "rule of thumb method" for determining the maximum size motor that could be fed from a 3-pole circuit breaker on any given lighting panel, without causing a noticeable flicker in the lighting?—R.V.H.

QUESTION Q35—At one of the mining properties, my attention was called when all 3-phase motors operated in reverse direction. The incoming line from the power company is 23000 volts, which had not been tampered with. From there we step down to 2300 with 3 delta connected transformers. At this point we have 75 KVAR of capacitors connected to the lines, also a single phase 2300 to 230-115 lighting transformer. This is then connected to three transformers with delta connections (2300 to 480 volts). All 3-phase power to motors is taken from the 480-volt taps. Why did these motors reverse direction after everyone was stopped?—E.H.

QUESTION R35—We have in our plant two conveyors; one feeds material into a steel-cutting saw and one removes material from the same saw.

Each conveyor is powered by a 5-hp, 1800-rpm, 3-phase motor without brake. Each motor is controlled by a magnetic reversing starter, it being operated with a forward and reverse momentary contact pushbutton.

Is there any method whereby we can control motor acceleration and deceleration to obtain smoother starting without replacing motors and control? Pushbutton operation is preferred.—E.S.J.

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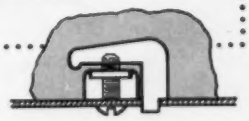

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Models with suffix 'X" (i.e. K-101X) have safety brackets, detailed above, which will hold on box ears should screw vibrate loose. Designed for use with 4" concrete rings, octagon boxes, SEH and GRF fittings.

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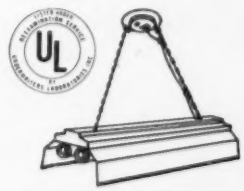

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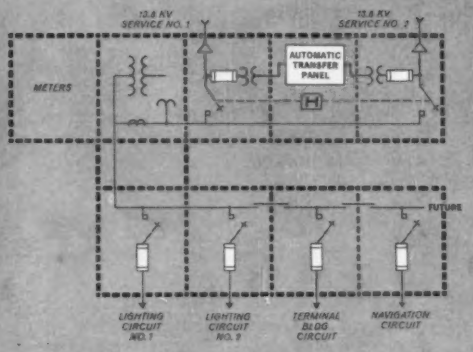
Answer:

There was *only one answer* to the requirements of maximum reliability, continuity of service, adequate short circuit protection, and full load switching, all at low cost —S&C Fused Load Interrupter Metalclad Switchgear.

Q: Why are power fuses and load interrupters used to replace circuit breakers in this type of switchgear?

A: Because conductors in such installations as this modern airport run in protected underground conduit and tunnels, and are not subject to transient faults caused by trees, wind, or rodents; protection against permanent faults is the only kind needed—and this is provided by S&C Power Fuses.



Q: How is automatic preferred-to-emergency transfer for service continuity provided in this S&C Metalclad Switchgear equipment?

A: By means of an S&C Standard Automatic Transfer Panel used with Moto-Draulic operator, a variety of throwover schemes is available at the flip of a switch. This transfer panel provides for making either source preferred; choice of automatic or manual return; choice of time delay (up to 10 minutes); and optional manual operation of line switches.

Q: Why can S&C offer savings up to 50% in this modern switchgear and still meet the highest standards of quality?

A: Because of the inherent simplicity of the S&C Fused Load Interrupter (compared to complex circuit breaker equipment), savings of 50% and more in the initial cost of switchgear equipment can be realized while the highest quality standards are maintained for the installation.

Q: How can you get information about such switchgear?

A: From S&C sales offices in principal cities. Consult your telephone directory.

S&C ELECTRIC COMPANY
4433 Ravenswood Ave., Chicago 40, Ill.

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New KILLARK Cast Aluminum

Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Bonding at Services

Q. *In the diagram below, according to the code, is the current transformer cabinet considered part of the service equipment? Or does the service terminate on the line side of the main disconnect?*

1—*Where are bonding bushings required?*

2—*Assuming concentric knockouts, determine proper size of bonding jumper.*

3—*Is C. T. considered service equipment?*

4—*If answer to No. 3 is no, is use of bare neutral a violation?*—*R.C.M.*

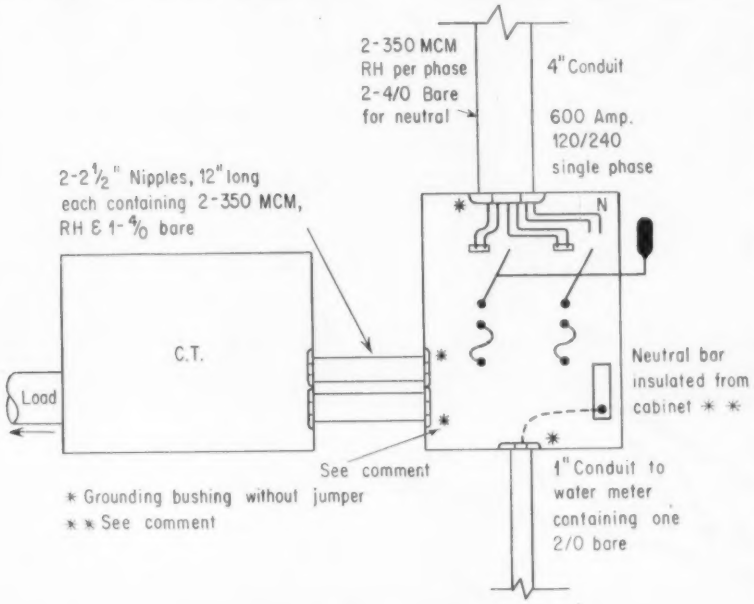
A. According to the definition of a service, and the various components of a service, as covered under Article 100, the service entrance conductors terminate at the line side of the service equipment. The 600-amp main switch and fuse is service equipment, but the conductors or any other equipment connected to the load side of this switch are not considered to be service equipment or service conductors. Since the current transformer is located on the load side of the service equipment, and is fed by conductors that are fully protected by overcurrent devices, it is not considered to be any part of the service equipment. If the transformer was located on the line side of the service equipment, it would be considered to be a part of the service and subject to the various service rules involved.

According to the provisions of Section 2571, all service equipment enclosures containing service entrance conductors including meter fittings, boxes or the like, interposed in the service raceway or armor shall be so connected that the continuity at service equipment will be assured when one of the methods covered by Section 2572 is satisfied. One of the means recognized is bonding bushings, and I have shown on your diagram where such bushings should be installed. Some inspectors believe that there is no occasion to install a bushing on the conduit which serves the load, since the conductors in this conduit are protected by the service overcurrent devices. All of the other conductors are service conductors, and in case of a ground fault there is no overcurrent protection other than a primary fuse at the transformer. As a result, when a fault occurs severe arcing will result if there are any poor connections in the grounding circuit.

Section 2572-b requires concentric knockouts to be bonded. While the code does not specifically cover the size of the bonding conductor, it appears to me that Section 2594 applies. As a result, since the size of the grounding conductor for the system is No. 2, a No. 2 should also be used when bonding concentric knockouts. I do not believe that we can depend upon such knockouts to carry very much of the fault current without destructive results, and this is what the code intends to avoid.

As already covered, the current-transformer enclosure is not considered as service equipment and a bare neutral conductor running to such an enclosure, as shown on the diagram, could not be used without violating the provisions of Section 2303-a. I am assuming, of course, that the C. T. is connected to the load side of the service equipment.

I note on your diagram that the neutral bar is insulated from the service switch enclosure. In view of the provision of Section 2553, which recognizes the use of a common grounding conductor, the usual procedure, on a 120/240-volt system, is to connect the neutral bar direct to the service switch enclosure, and to connect the circuit grounding conductor to the neutral bar. Such procedure eliminates the occasion to run two grounding conductors, one for the circuit and the other for the equipment, to the grounding electrode. On systems where the voltage exceeds 150 volts to ground, and you do not wish to ground the system, the neutral bar would have to be insulated from the service equipment enclosure. The use of a common ground conductor has proven to be a most effective means of clearing ground faults.—B.A.McD.—12/59/1



Hermetically Sealed Motors

Q. *Does the code permit a 3-phase packaged air conditioning unit (not a window unit) with a rating of 9.8 amps full load and locked rotor current of 60 amps on the compressor and a fan rated as 1/6 hp, 220-volt single phase on a circuit of three No. 10 wires on a*

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New KILLARK *Cast Aluminum* go all the way

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WITH FLAT COVER

Every single feature in the new Killark Junction Boxes—right down to the corrosion protected screws—has been designed to assure 100% satisfaction and reliability on the job.

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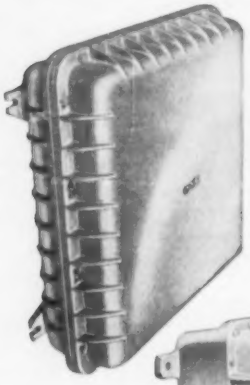

▲ STYLE 2
WITH EXTERNAL RIB DESIGN ON BOX AND RAISED COVER

▲ STYLE 3
WITH RAISED COVER

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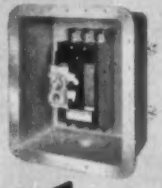

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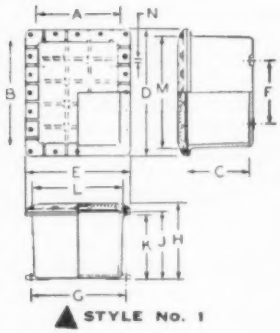
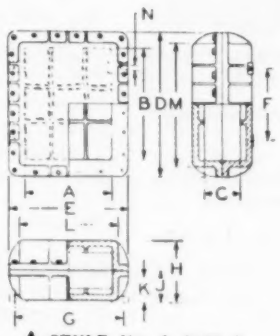
Catalog Numbers and Dimensions

Catalog No. (See note below)	STYLE ▲	INSIDE BOX SIZE A Width	B Length	C Depth	DIMENSIONS D	E	F	G	H	J	K	L	M	WALL THICK.	WT., LB. EACH	MAX. HUB SIZE
5106.....	2	5½	10½	6	13¼	8¼	8½	7⅛	7⅞	3 13/16	3½	6⅜	11⅜	⅞	22	2
5133.....	1	5½	13	3	15¾	8¼	11	7⅛	4⅞	3 13/16	3½	6⅜	13⅞	⅞	16	2
5136.....	2	5½	13	6	15¾	8¼	11	7⅛	7⅞	3 13/16	3½	6⅜	13⅞	⅞	25	2
5183.....	1	5½	18	3	20¾	8¼	16	7⅛	4⅞	3 13/16	3½	6⅜	18⅞	⅞	21	2
5186.....	2	5½	18	6	20¾	8¼	16	7⅛	7⅞	3 13/16	3½	6⅜	18⅞	⅞	31	2
6104.....	2	6½	10	4	12¾	9½	5½	8½	6	3	2½	7⅜	10⅞	⅞	21	1¼
6105.....	2	6½	10	5	12¾	9½	5½	8½	7	4	3½	7⅜	10⅞	⅞	23	2
6106.....	2	6½	10	6	12¾	9½	5½	8½	8	4	3½	7⅜	10⅞	⅞	25	2
6366.....	1	6	36	6	39	9	30	8⅛	8¾	7⅛	6½	7¼	37¼	⅞	73	4
884.....	1	8	8	4	10	10	6	9 11/16	5⅝	4⅝	4⅛	9	9	½	18	2
886.....	1	8	8	6	10	10	6	9 11/16	7⅛	6⅝	6¼	9	9	½	20	2
8106.....	1	10	8	6	12	10	6	9 11/16	7⅛	6⅝	6¼	9	11	½	24	2
8216.....	2	8	21	6	24	11	18	11	8	4	3⅜	9	22	½	55	2
10126.....	1	12	10	6	14	12	6	11	7⅛	6⅝	6¼	13	11	½	30	2
10166.....	2	10	16	6	19	13	12	12	8	4	3⅜	11	17	½	48	2
10246.....	2	10	24	6	27	13	19½	12	8	4	3⅜	11	25	½	67	2
12128.....	1	12	12	8	14	14	6	13	9⅛	8⅛	8⅛	13	13	½	45	6
12168.....	1	12	16	8	18½	14½	12	13½	9⅛	8⅛	8⅛	13	17	½	55	6
12196.....	2	12	19	6	22	15	16	14	8	4	3⅜	13	20	⅝	65	2
12198.....	2	12	19	8	22	15	16	14	10⅛	6⅛	5½	13½	20¼	⅝	78	4
121910.....	2	12	19	10	22	15	16	14	12¼	6⅛	5½	13¼	20¼	⅝	80	4
12243.....	1	12	24	3	26⅜	14½	19½	14	5	4	3⅜	13	25	½	58	1½
12245.....	1	12	24	5	26⅜	14½	19½	14½	7⅜	6⅛	5½	13	25	⅝	68	4
12246.....	2	12	24	6	26⅜	14½	19½	14	8	4	3⅜	13	25	⅝	70	1½
12248.....	3	12	24	8	26⅜	14½	19½	14½	10	6⅛	5½	13	25	⅝	80	4
12323.....	1	12	32	3	35	15	19½	14	5¼	4	3⅜	13	33	½	93	2
12326.....	2	12	32	6	35	15	19½	14	8	4	3⅜	13	33	½	95	2
12328.....	1	12	32	8	32	15	19½	14	10	8 11/16	8⅛	13	33	⅝	98	6
123211.....	2	12	32	11	35	15	19½	14	13⅛	8⅝	8	13¼	33¼	⅝	125	4
12406.....	2	12	40	6	43	15	36	14	8	4	3⅜	13	41	½	120	2
12408.....	2	12	40	8	43	15	36	14	10½	6½	5½	13¼	41½	⅝	130	4
124010.....	2	12	40	10	43	15	36	14	12¼	6⅛	5½	13¼	41¼	⅝	145	4
16488.....	2	16	48	8	51	19	42	18	8	4	3⅜	17	49	½	210	2
164810.....	2	16	48	10	51	19	42	18	10⅛	4	3⅜	17¼	49¼	⅝	225	4
164812.....	2	16	48	12	51	19	42	18	8	4	3⅜	17¼	49¼	⅝	240	4
24246.....	2	24	24	6	27	27	26	19½	8	4	3⅜	25	25	½	120	2
24248.....	2	24	24	8	27	27	19½	26	10⅛	6⅛	5½	25¼	25¼	⅝	136	4
242410.....	2	24	24	10	27	27	19½	26	12¼	6⅛	5½	25¼	25¼	⅝	150	4

NOTE: Use following prefixes to designate type:
WJB—Weatherproof DJB—Dust-Tight
XJB—Explosion-Proof Example: WJB-5106, Weatherproof type box.

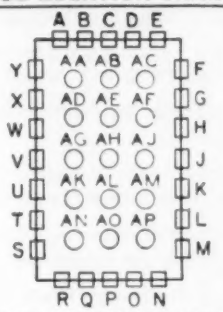


▲ STYLE No. 1



▲ STYLE No. 2 AND 3

HUB LOCATION CHART



DRAWING INDICATES HUB POSITION AS LOOKING INTO OPEN FACE OF BOX WITH SHORT SIDE (TOP) UP

HUB STYLES AND SIZES

CONDUIT SIZE	SYMBOL NUMBERS DRILLED and TAPPED	UNION
½	1	11
¾	2	12
1	3	13
1¼	4	14
1½	5	15
2	6	16
2½	7	.....
3	8	.....
3½	9	.....
4	0	.....
5	02	.....
6	04	.....

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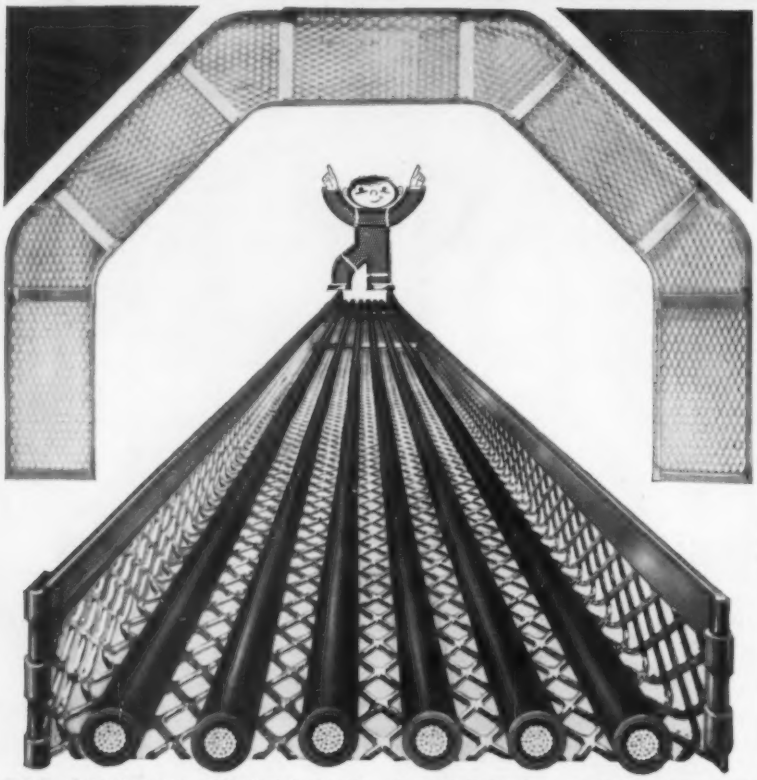

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30-amp, 3-pole multibreaker? The panel is a Square D, marked 110-208-240-*volt, 3-phase. Sections* 4341, 4343b1, 2, 3, 4, 5, 4403b.—*H.I.*

A. The maximum rating of the motor branch circuit would be based on the starting of the larger motor with the smaller motor running. In this case the larger motor would require a maximum of 250% rating or 2.5 times 9.8 or 24.5 amps. To this is added the 2.2 amps for the 1/6 hp single phase motor for a total load of 26.7 amps. The 30-amp breaker is sufficient.

The minimum size of conductor would be based on 125% of the larger motor rating plus the running current of the smaller motor. This would be 1¼ times 9.8 amps or 12¼ amps plus 2.2 or a total of approximately 14½ amps. A No. 10 conductor has a rating of 30 amps so that the circuit is considerably in excess of the minimum size required.

With reference to the group installation of these two motors on a single branch circuit the requirements in 4343b would have to be met, as you indicate. Basically, the two motors would have to have a separate controller, each approved for "GROUP INSTALLATION". It would not be required to break this circuit up into two separate branch circuits with two sets of branch circuit multibreakers, if each motor has an approved "GROUP INSTALLATION" starter and all five of the requirements of 4343b are met.

Section 4403b and its corollary rule 4383e are used to establish the minimum horsepower rating of the disconnect and controllor based on the motor's actual full load and locked rotor currents. For the motor shown we have a hp rating based on the full load current of 9.8 amps by Table 24, of 3 hp. Based on the locked rotor current of 60 amps, Table 25 shows the hp rating to be somewhere between 2 and 5 hp.

In the case of the circuit breaker we do not have to worry about its hp rating since inherently these breakers have considerable interrupting capacity. In the case of the fuse switch combination we do have several grades of these, some of which serve quite well as disconnecting means but are not capable of interrupting motor locked rotor currents. So we must make sure that the switch selected is rated in horsepower of sufficient capacity. These latter rules set up minimum horsepower rating for the disconnect and also the minimum rating for the motor controller.—B.Z.S.—12/59/2

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crimp splice you've ever seen...

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IDEAL

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with the UNIQUE DIAPER WRAP INSULATOR

Flash-proof all around the joint and *between the wires, too!*

"Wrap-Cap" Crimp Connectors give you perfect, prefabricated insulation on every joint, every time . . . *the easy way.*

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1. "Wrap-Cap" Insulators are virtually puncture-proof, with *extra-thick* protection over wire ends.
2. Deep skirt completely covers bare conductor — even if wires are *not* stripped evenly.
3. High-tensile cadmium-plated steel sleeve has greater gripping power—vibration-proof—pull-proof—with low electrical resistance.

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Listed as pressure cable connectors for general use (600 V.) in branch circuit and fixture wiring.

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169

PRODUCTS DIVISION

The **GLOBE** *Company* MANUFACTURERS SINCE 1914

4032 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

Green Covered Grounding Conductor

Q. *In my work on construction of electrical work, I had a shipment of wire sent in, and there were two coils of No. 12 RH green wire. This is the first time in quite a few years that I have seen green wire used for a circuit feeder.*

My question is—is it a violation of the electrical code to use a solid green color wire for a circuit feeder? I have always used a green wire for a mechanical ground. In the code book, 1956 Edition, section 94003-A & B is all I can find regarding grounding colors.

I would appreciate it very much to have you explain a better version regarding the use of this green wire in question.—R.C.M.

A. According to the provisions of Section 2112 "any conductor intended solely for grounding purposes shall be identified by a green color unless it be bare. Conductors having a green covering shall not be used for other than grounding purposes". This rule first appeared in the 1953 edition of the code.

Section 2557-a requires that a grounding conductor run with circuit conductors, if provided with an individual covering, the covering shall be green. Reference to a green covered grounding conductor is also made in Sections 6670-b, 6723, 2559-b, and 94003-b.

It appears evident from the foregoing, that the No. 12 green covered conductors cannot be used for the wiring of branch circuits, or for any purpose other than a grounding conductor.—B.A.McD.—12/59/3

Gas Pipe Grounding

Q. *Under what conditions would you use a gas line for a grounding electrode?—C.L.W.*

A. It should be noted that Sections 2581, 2582 and 2583 are quite specific as to their requirements.

Section 2581 states that "A metallic underground water piping system, either local or supplying a community, *shall always be used* as the grounding electrode where such a piping system is available." Section 2582 states that "Where a water system as described in Section 2581 is not available . . .", three alternatives may be used. One of these permits grounding to a gas piping system.

Section 2583 permits the use of made electrodes; i.e., ground plates, etc., when neither Section 2581 nor Section 2582 can be applied.

It is interesting to note that a formal proposal has been made to delete from the code the use of gas piping systems for grounding. This is still under study by the industry and it is believed that some changes will be made to obtain more satisfactory grounding with gas piping electrodes.—B.Z.S.—12/59/4

Derating of Conductors

Q. *There are six No. 12 wires in a 1-in. pipe from a panel to a junction box; two wires are for a lighting circuit and the other four wires are for two circuits of 220 volts for window air conditioning units. Note 4 of Table 1 says the current carrying capacity of each wire is reduced to 80% of Table 1 values. Section 4293 says the total load of motor operated air-conditioning equipment shall not exceed 80% of the rating of a branch circuit, etc. Do you derate these wires twice? What size fuse or multi-breaker would you use on these circuits?—H.I.*

A. I would say no, you do not have to derate twice.

Note 4 states that the current carrying capacity of the wire has to be reduced 20% because more than three conductors are in the raceway. The size of wire being No. 12 would ordinarily give it a rating of 20 amps for copper conductors. For this case each wire however would have a capacity of .8 times 20 or 16 amps.

Section 4293, in effect, requires a similar derating for the air-conditioning load only, for quite a different reason. We are not primarily interested in derating the conductors because of the cumulative effect of the heat build up from the conductors. Now we are derating to secure proper starting of the motors of the air conditioning units by maintaining a minimum voltage drop when these motors are started.

However, for all practical purposes, both rules provide that the branch circuit conductors will not be loaded to a point beyond 80% of their capacity.

Since the No. 12 conductors originally have a 20-amp rating, we may use 20-amp branch circuit fuses or circuit breakers. It will be necessary to derate these conductors only once.—B.Z.S.—12/59/5

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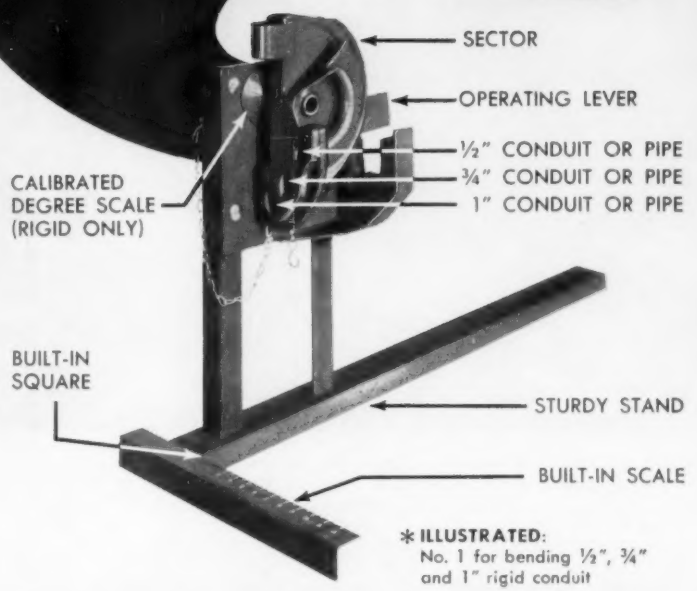

* ILLUSTRATED: No. 1 for bending ½", ¾" and 1" rigid conduit

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These are complete machines of all steel construction and their light weight (*66 lbs. including stand) make them a real on-the-job tool. There are no loose parts to be misplaced or lost and the only maintenance is an occasional drop of oil. You get accurate bends every time . . . no strain, slipping or loose parts to worry about. Benders work equally well on aluminum or steel conduit. Ask the electrician who is using one; he will tell you it's the finest tool available and at a price that is eminently reasonable.

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	No. 1	No. 1T
½" conduit or pipe	2"	EMT 3"
¾" conduit or pipe	4¼"	EMT 4½"
1" conduit or pipe	5¾"	EMT 6½"
	No. 2	**No. 2T**
1¼" conduit or pipe	7¼"	EMT 9½"
1½" conduit or pipe	8¾"	EMT 10½"

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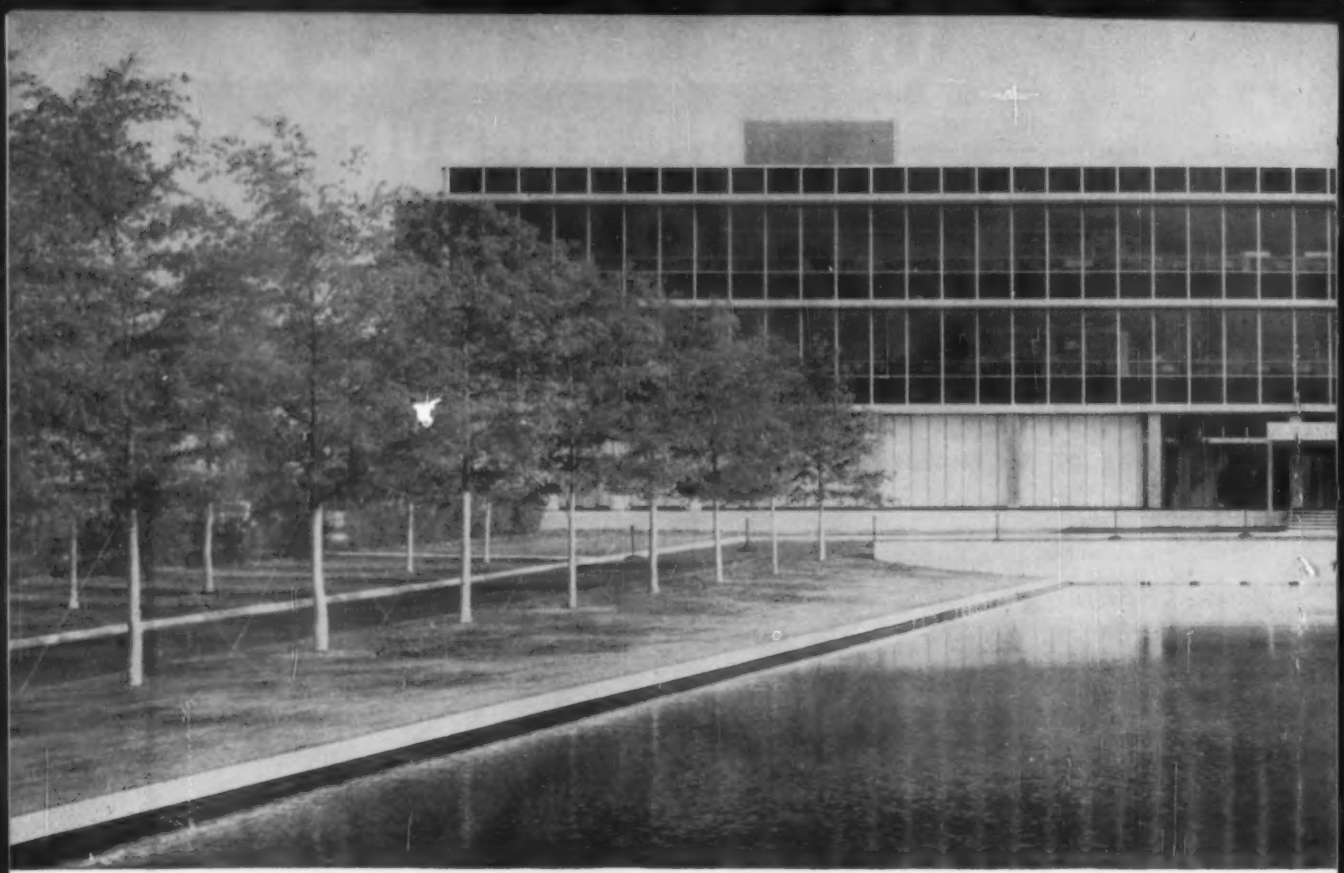
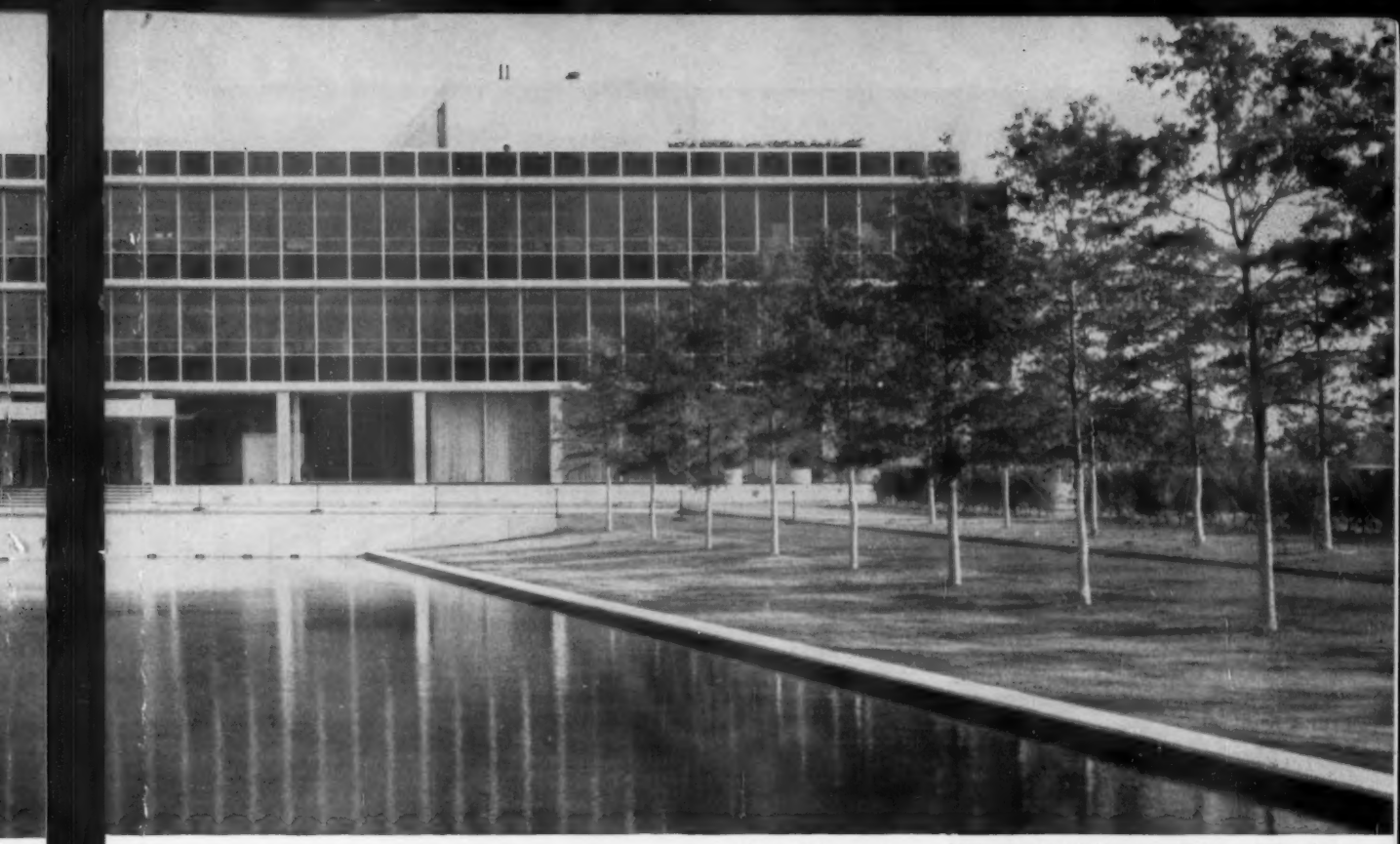


Maximum flexibility in space utilization is achieved at Reynolds through partitions that easily can be moved to expand or decrease area sizes. This can be accomplished without making costly changes in the lighting system. The Curtis wall-to-wall ceiling of light provides 80 ft. candles of maintained illumination. Attractive Hexcel Honeylite aluminum diffusers complement the inviting decor.

How a special Curtis Lighting system saved Reynolds Metals $50,000 . . .



Here is the new home of Reynolds Metals Company, Richmond, Va. It is dramatically placed at the end of a reflecting pool bordered by willow oaks. The classic beauty of the building is enhanced by this unusual setting. Architect: Skidmore, Owings & Merrill; Consulting Engineer: Ebasco Services, Inc.

Unique all-aluminum folding grids in 100 sq. ft. units cut installation time 8,000 man hours . . . provided wall-to-wall illumination with low brightness quality

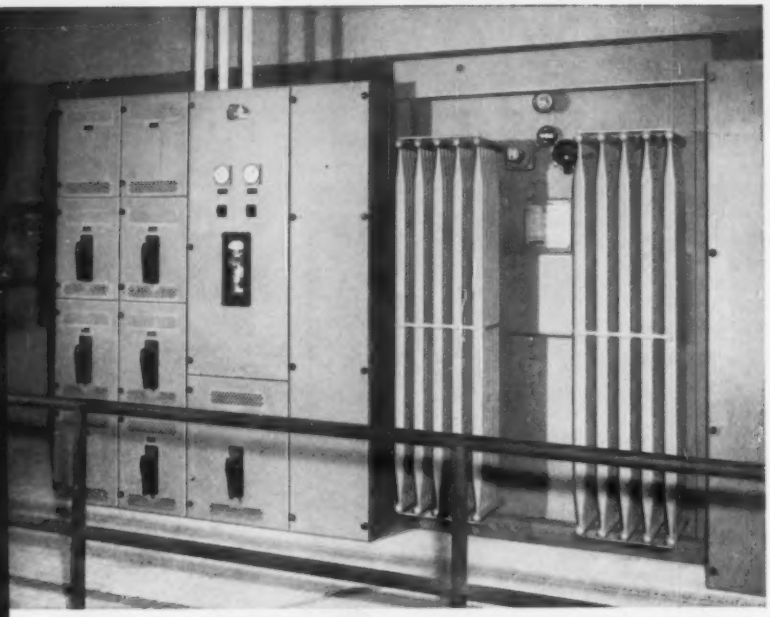
Installing a lighting system so flexible it can adapt to any internal building change without relocation is quite a feat. But when that is accomplished at important savings it calls for exceptional engineering ingenuity. That's what Curtis Visioneers achieved with a special custom-made aluminum folding grid system at Reynolds Metals Company, Richmond, Va. The unique folding "packages" made it possible to install 100 sq. ft. of lighting at one time. Result: a saving to Reynolds of an estimated 8,000 man hours, or approximately $50,000. A wall-to-wall ceiling of light was created with a beautiful satiny aluminum lighting tone of low brightness quality. Over-all ceiling illumination solved the problem of how to obtain stationary lighting for a 100,000 sq. ft. area, even though wall partitions would be moved in the future. Write today for the name and address of the Curtis Visioneer in the principal city nearest you. Curtis Lighting, Inc., 6135 West 65th St., Chicago 38, Ill. In Canada: 195 Wicksteed Ave., Toronto 17, Canada.

CURTIS

Visioneers in Planned Lighting

Large office areas are as effectively illuminated as small areas with a high degree of visual comfort assured. In this special Curtis grid installation, aluminum materials were used throughout. Maintenance features of the system include ease of relamping, ready access to wiring, simple replacement of ballasts.

WAGNER Close-Coupled Transformer permits compact load-center for TRANE COMPANY



This Wagner 1000 kva Noflamol close-coupled Transformer is installed in Trane Company's new $1,250,000 Engineering Building.

One of the many unusual features of The Trane Company's new Engineering Building at LaCrosse, Wisconsin, is a display room for the air conditioning equipment that serves the building. A full glass wall in this room permits visitors to view the Trane CenTraVac water chiller and master control panel, the pump room and the unit substation that handles the power load distribution for the building.

A Type JP 1000 kva Wagner close-coupled transformer was chosen to power the unit substation. Wagner close-coupled transformers fit flush against the switchgear enclosures, eliminating throats and saving space. Connections are made at the bushings on the sides of the transformer. Bushing heights are designed to give ample room for connection to switchgear or busses and eliminate need for special throats to match special switchgear. These noninflammable liquid-filled transformers are available in ratings from 500 through 2000 kva.

Consult your nearby Wagner Sales Engineer about the complete Wagner line of Unit Substation Transformers —both liquid-filled and dry-type. Bulletins TU-205 and TU-214 give full information on Wagner Unit Substation Transformers for industrial power needs. Write for your file copy today.

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WT58-2

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Motor Shops

VARNISH SOLVENT is poured into a small container which is positioned inside the dipping tank. Top of container is half-inch below tank cover, so fumes are permitted to circulate, thereby keeping inside of cover and upper side walls of tank free from hardened varnish.

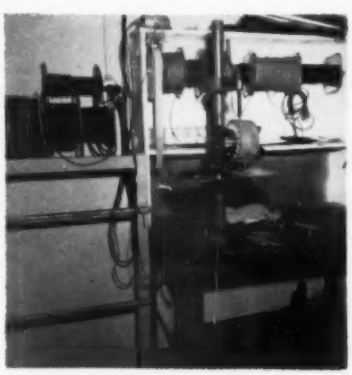
Solvent Container Prevents Varnish from Hardening

The problem of keeping varnish from gumming up and hardening on the inside cover and upper side walls of a dipping tank is solved by Riles Armature Winding, Roanoke, Va., by constructing a small container for the purpose of holding solvent. This square metal container is secured in one of the front corners of the tank and, since the lip of the container is about a half inch below the surface of the tank cover in its lowered position, fumes of the solvent are permitted to rise and mushroom out over the inside of the cover. The tank cover fits snugly over the tank rim, so although solvent fumes are free to circulate inside, they cannot escape into the shop proper.

Bench-Type Stator Holder

A special stator holder that is completely adjustable for holding and positioning stators up to 12 ins. in diameter is used in the shop of Franklin Electric Company, Evansville, Indiana. The simply constructed stand saves considerable time and effort when rewinding stators.

The main support for the stand is a heavy 4-in. by 10-in. metal base bolted securely to a small work bench. A built-in collar with set screws holds a 3 ft pedestal of 1¼-in. pipe. An 8-in. by 12-in. steel table is welded to a sliding collar on the 1¼-in. pipe. Set screws in this collar permit locking the table on the shaft at any desired height. A 2-in. V-saddle welded to the adjustable table seats the stator being rewound and enables workmen to rotate it to any desired position.



FRONT VIEW of bench-type stator holder shows simple construction of the device. A 2-in. V-saddle welded to an adjustable steel table, and an adjustable screw-clamp arm enables stator being rewound to be locked-in any position, saving considerable time and effort during rewinding process.

Once seated in the V-saddle, the stator is held securely in position by a screw-clamp supported by an adjustable arm. The clamp arm has a set-screw collar which slides up and down on the stand pedestal. Final locking pressure is applied to the stator by turning a crank-handle on the clamp screw.

"Freon" Solvents for Economical Motor Cleaning

Cost of cleaning large electric motors might be reduced as much as 75% through on-site use of nonflammable, nonexplosive, and virtually nontoxic "Freon" solvents, according to tests conducted by the Du Pont Company.

Aside from the cost and safety advantages, the company added, the "Freon" solvents are of particular value in such applications because unlike other commonly used nonflammable solvent cleaners, they will not attack insulating materials and varnishes used on motor windings. The fact that they permit in-place cleaning, rather than requiring dismantling of the motor for repair shop cleaning, not only reduces equipment down-time but makes more practical a continuing program of preventive maintenance.

As an example of the potential savings, an enclosed 600-hp motor, used to drive a centrifugal refrigeration compressor at the company's Parkersburg, W. Va., plant, was cleaned in one day, without dismantling, at a solvent cost of about $80. Cleaning the same motor previously cost nearly $400, including dismantling for shipment to an off-plant cleaning and service site.

Not computed in the costs, but representing significant additional savings, was labor required in dismantling and reinstalling the motor. In cleaning with "Freon"-TF solvent, only the end bells and coil shields were removed from the motor to permit access to the armature coil and stator area. "Freon"-TF solvent then was sprayed on the one-sixteenth-inch coating of oil, grease, and dirt that had accumulated on the coil and stator surfaces. Most of the softened ac-

saves time and money

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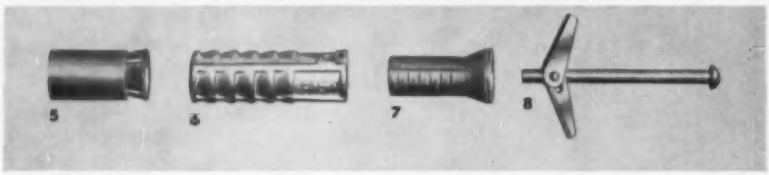
complete line of holding, anchoring and fastening fittings



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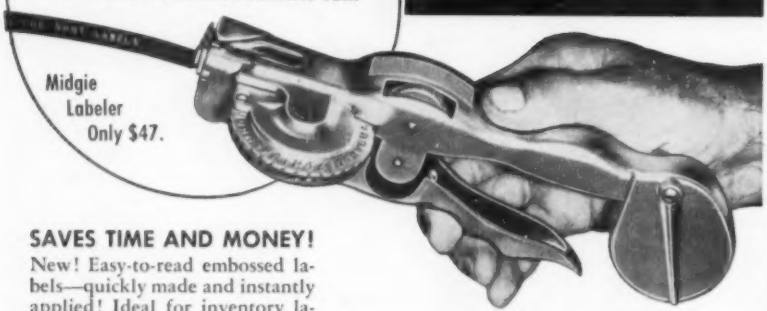

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cumulation was then simply brushed off with a small paint brush. The finished cleaning was accomplished by high velocity power-spraying of "Freon" over the coil and stator, and removing the solvent-dirt mixture from the bottom of the motor housing.

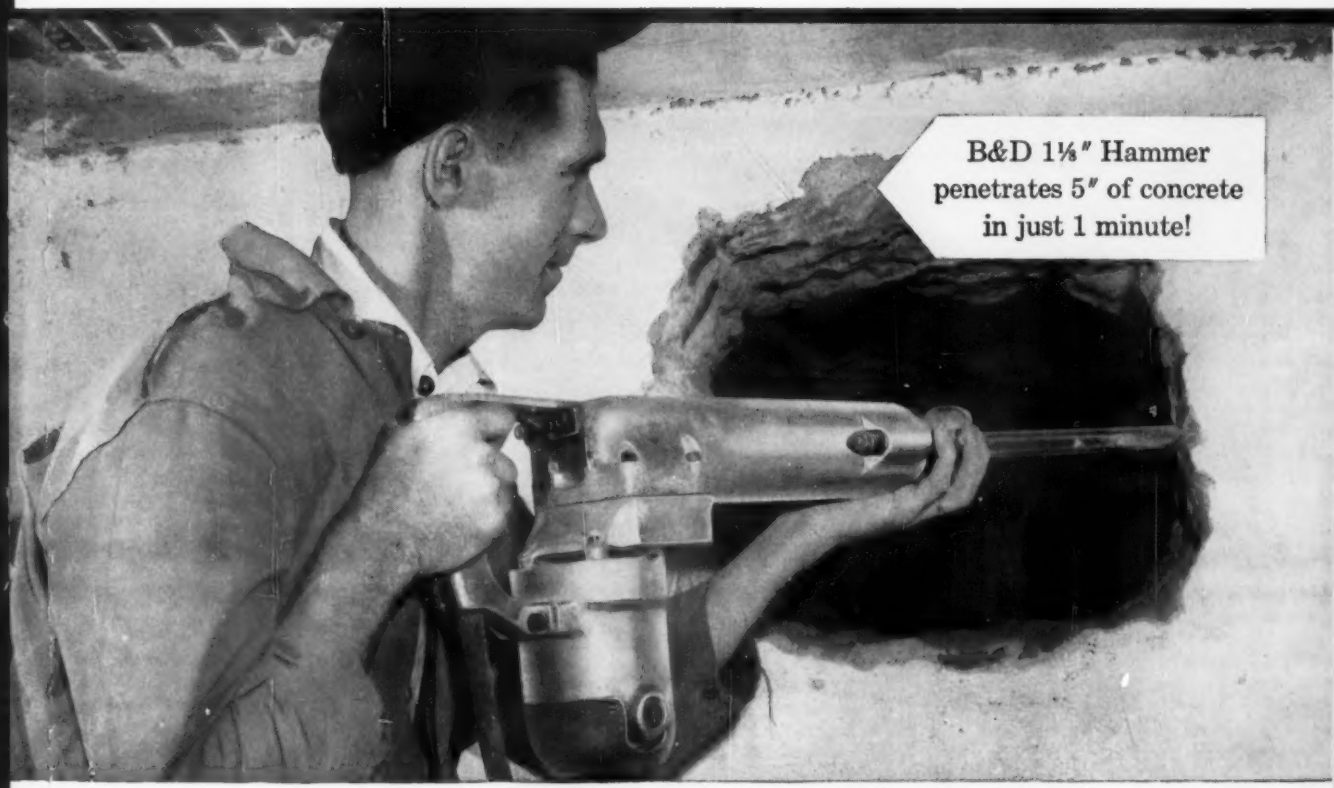
Total labor involved in readying the motor for cleaning and reinstalling the coil shields and end bells after cleaning was 16 hours. The cleaning procedure itself required only two hours, and the motor was ready for use the following day. Normally, plant officials explained, it would have required several men a full day to dismantle the motor and ship it to an outside cleaning shop, and the same time to reassemble the motor when it was returned a week later.

Even faster and better cleaning would be attained on motors where housings permit introducing the liquid "Freon"-TF solvent into a liquid-tight housing around the bottom of the motor, so that the motor could be turned over in the liquid bath. The solvent-soil mixture then would be removed through an outlet in the bottom of the liquid-tight housing and the motor would be ready for use within a few hours after cleaning. No special drying equipment is required with "Freon"-TF because of its favorable vaporization temperature.

No damage to motor windings through use of "Freon"-TF solvent has been reported or is anticipated, Du Pont chemists said, because "Freon" is extremely inert to insulating materials and varnishes used on motor windings. While the "Freon" in itself may not dissolve highly oxidized carbon deposits, such a condition is seldom found in well maintained electric motors, they added. In most cases, the soil which initially accumulates on motor windings consists of an oil-in-carbon mixture, which is removed effectively by "Freon".

Dolly Screens Keep Oven Floors Clean

The simple expedient of covering the top of bake oven dollies with fine mesh metal window screening is saving hours of clean-up time in the large motor repair department of Electrical Engineering & Equipment Co., Des Moines, Iowa. Previously, excess varnish drippings from equipment being baked fell through the dolly rails to the oven floor and the loading area immediately in front of the oven. At regu-



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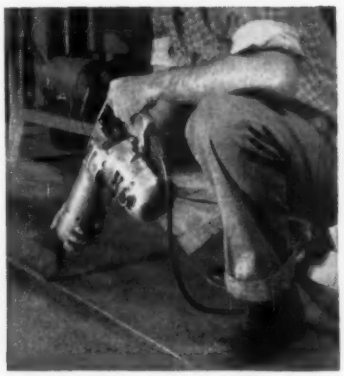

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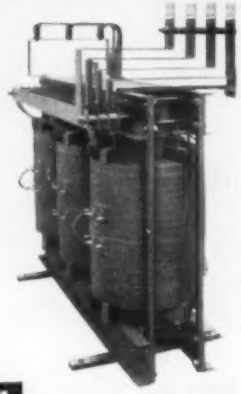

PLACE: Student Union Building, Alabama Polytechnic Institute, Auburn, Alabama

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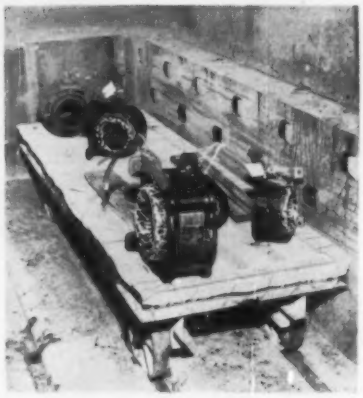


FINE MESH metal screening covers oven dolly, collects excess varnish drippings, helps keep oven floor clean. Dirty screening can be easily removed and replaced.

lar intervals, hours were spent scraping caked varnish puddles from the floor. Now, the screening retains this excess varnish and keeps the oven floor clean.

Two oven dollies, rolling on depressed channel-iron "tracks" are covered with the screening. One is 30 ins. by 70 ins.; the other 28 ins. by 84 ins. Both keep stators and rotors about 18 ins. above the floor. In each case, the section of screening is large enough to lap over the sides of the dolly bed and is wired securely in place.

For normal shop operation, the screens are changed about every six months. A heavy run of repairs might shorten this period somewhat. The criteria is the amount of varnish accumulated on the screen surface. When a change is necessary, the old screen is simply removed, rolled up, discarded, and replaced in a matter of minutes.

Mobile Tank Solves Shop Dipping Problem

If you can't bring the work to the machine, then bring the machine to the work. That is the premise on which Russell Booth and Leo Sibert operate their successful motor repair service in Tiffin, Ohio. When they found that installation of extensive crane and hoist facilities was limited by basic building structural features, they designed mobility into much of their shop equipment. The varnish dip tank was one of the items put on wheels.

The rectangular tank at Sibert-Booth Co. is made from five sections of ¼-in. steel deck plate. Sides and bottom are welded to form a 40-in. by 35-in. by 29-in. deep vat which holds 110 gallons of water-

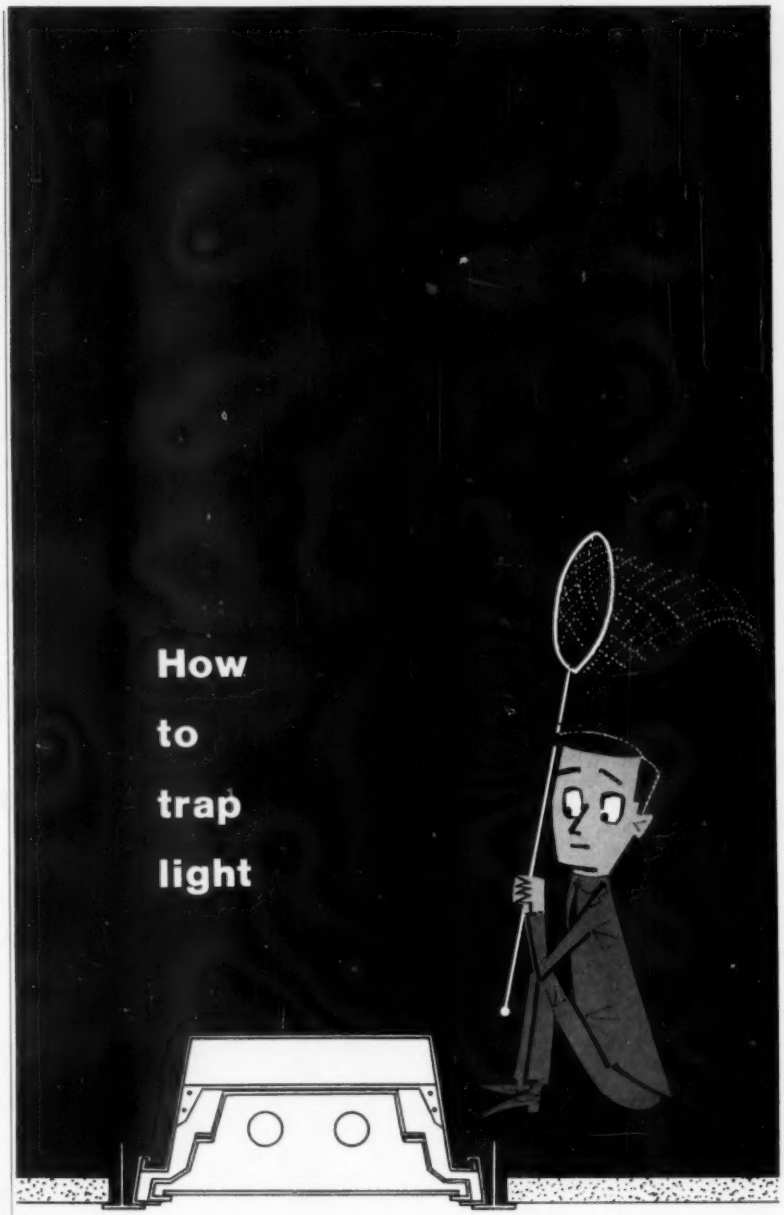
MOBILE DIP TANK in normal position for small motor work. Deck-plate unit on casters can be rolled to 5-ton hoist for larger equipment. Sheet-metal lift-cover is used with water-soluble varnish.

soluble insulating varnish. A flanged, sheet-metal lift-cover fits the top of the tank. The unit rests on four heavy 4-in. swivel casters; has sturdy handles welded to two sides; is easy to move from place to place in the shop; can take stators up to 150 hp, 1200 rpm size.

Normally, the tank is spotted under the smaller of two shop hoists. When large, heavy equipment must be dipped, the tank is rolled under the 5-ton hoist and returned to its original spot while the impregnated equipment is in the bake oven. With the varnish they use, Booth and Sibert report an average baking time of eight hours. Smaller motors take about six hours, larger ones around 12 hours.

Shop mechanics like the mobile feature of their dip tank and find their equipment handling time substantially reduced. It is easier to roll out the varnish than move the heavy, bulky motor stators.

A VARIETY OF TAGS printed with such directives or reminders as "Rush", "Warranty", "Estimate Only" and "Hold" are used at the check-in counter of Lange Electric's shop in Baltimore to inform foremen at a glance of the disposition or status of incoming motors. Tags are wax-covered to prolong life.



Specify METCO AURORA recessed fluorescent troffers. AURORA's new, exclusive light-tight trim and frame of extruded aluminum seals the troffer body against light leaks, increases useable light output. Write for METCO Bulletin T-1257.

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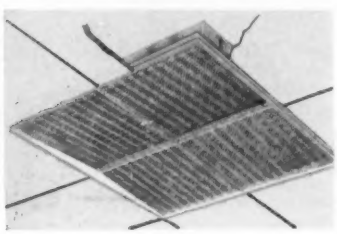

metco Lighting

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Mascher & Lippincott Sts.
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McGILL® PORTABLE LAMP GUARDS are always a little better ...and all are UL inspected

- Rugged, steel wire cage. Spot-welded with extra heavy zinc plated, chromate finish.
- Tough, gray molded phenolic handle resists impact, heat oils, greases, some acids, moisture and abrasion.
- Concentrating end lens. • Convenience hook.
- Approved 3-wire grounded convenience outlet.
- Exclusive McGill LEVOLIER Switch. • Rotary reflector.

No. 5000 SLRG

LEVOLIER SWITCH AND SOCKET ASSEMBLY
APPROVED 3-WIRE GROUNDED CONVENIENCE OUTLET
SCREW SHELL ARE HEAVIER THAN STANDARD
IMPACT RESISTING MOLDED PHENOLIC PLASTIC HANDLE
RUBBER GASKET
STRAIN RELIEF CLAMP

An extra margin of quality is designed and built into the complete line of McGILL industrial portable lamp guards for safe, dependable utility. Rugged, heavy duty construction and selected materials withstand the punishment of rough use. The famous McGILL LEVOLIER switch mechanism provides a degree of dependability not found in ordinary portables. It's economical to specify the best.

More than 100 different types of McGILL portable lamp guards have been developed to meet the particular requirements of a wide range of service conditions. Cages 50 to 200 watt. 660 watt, 250 volt sockets.

For detailed descriptions of the McGILL line of top quality electrial specialties, including portable lamp guards, and Levolier switches write for McGILL ELECTRICAL SPECIALTIES CATALOG No. 84.

No. 7100 SR Lamp Guard

Thumb clamp arrangement for cage to change lamps quickly without tools. Gray Neoprene-butyl handle; reflector; LEVOLIER switch.

No. 5025 SRG Service Light

Completely grounded service light. 15 amp., 125 volt convenience outlet built into molded phenolic handle. Safe on-the job source for power tools. Levolier switch and 25 ft. 16-3-SJ gray rubber cord.

No. 5000 SR Lamp Guard

With 15 amp., 125 volt convenience outlet in impact and heat and grease-resisting positively insulating molded phenolic handle. No-Rol cage, Levolier switch and reflector.

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Watertight, vaporproof and moistureproof for complete safety. Heat and impact resisting glass globe screws into a silicone rubber gasket. Handle molded of macerated phenolic.

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Rubber hook handle, thumb release clamp for easy bulb replacement. Can be hung, for maximum light, from hook or handle.

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Transistor Devices Create New Dimming System

Silicon controlled rectifiers, a semi-conductor development in the transistor family, bid fair to revolutionize the field of lighting control. Now in production by the Semi-Conductor Product Division of the General Electric Company for extensive military use, these miniature devices have recently been adapted for use in light control systems, or as dimmers. Two manufacturers of dimmers, each of which also make stage and TV studio lighting equipment as well as other types of lighting units, announced the availability of silicon controlled rectifier dimmers late last year, following several months of research, experimentation and testing. These two firms are Century Lighting Inc. and Kliegl Bros., both of New York City.

Essentially, the silicon controlled rectifier is a solid state product developed from silicon, a metal. Its crystal structure is such that it presents a barrier to the flow of electric current in one direction, while it conducts it easily in the other. When used as a dimmer for lighting, it is installed in the lighting circuit in series with the lightng load and operates as a "valve" in controlling the amount of current flowing in the circuit. A low-voltage potentiometer circuit is used to operate the "valve", or to control the lighting load current.

Currently available silicon controlled rectifiers are truly midget-sized, or about the size of a small acorn. Models are now available which will handle lighting loads up to 5 kw, when circuited in pairs, and installed in special dimmer circuits. Larger sizes are expected to be available in the near future.

Dimmer models now in production are of two types. One type uses two controlled rectifiers installed "back-to-back", combined in a special electronic circuit with necessary components, quite similar to that of a two-tube electronic (thyratron) dimmer arrangement. This type has a potentiometer operating on a 24-volt circuit which provides the control signal to the two silicon controlled rectifiers, to control the total lighting load current and thus provide the necessary dimming. This model dimmer is available in two capacities, a 4-kw unit by Kliegl Bros., and a 5-kw unit by Century Lighting, Inc. These units will handle any lighting load up to full capacity, providing dimming from full intensity to full blackout.

The circuit for the other model uses only one silicon controlled rectifier, but incorporates auxiliary equipment in the circuit to compensate for the omission of the second controlled rectifier. This model requires a slightly larger chassis and uses about 2.5 times as much metal. Its control circuit loss is about 25 watts, compared with 50 watts for the two-rectifier model; otherwise it is similar in practically all other respects. This model is available from Century Lighting, Inc.

These new controlled rectifier dimmers offer extraordinary weight-and-size reductions over all other types of dimmers—electronic, magnetic amplifier, motor-driven autotransformer—and also provide many other outstanding features. Response is instantaneous. Efficiency is highest, over 98%, compared with about 90% for electronic dimmers, and 95-97% for autotransformer dimmers. The loading range is infinite, and no auxiliary apparatus is required. They operate on standard 120-volt alternating current, without need for power transformation. They can be connected for proportional mastering, sub-mastering, and fading.

These dimmers will find immediate use in television studio lighting applications. They will also find wide application in high school auditoriums and commercial applications where space and weight of equipment is a problem.

Further, according to Century Lighting, these new dimmers make it posible to change our thinking and philosophy regarding dimmer control systems. They will make it possible, because of their substantially reduced overall cost, to eliminate load cross-connect patch panels and to make use of more dimmers. It is envisioned that eventually a dimmer will be used for every lighting circuit and, because of their light weight and small size, they can be located close to the lighting equipment that they control. This means the elimination of heavy and long runs of load cables.

As production of silicon controlled rectifiers is increased, and

REPRESENTATIVES from all segments of the industrial and commercial lighting industry met in New York December 2, 1958 to complete plans for Eye-Fi Relighting promotion. Present were: (seated—l to r)—James R. Steel, Sylvania; W. W. Booth, G. E. Supply Corp; A. W. Hooper, NAED; B. F. Benning, Graybar; A. F. Wakefield, The Wakefield Co, (elected chairman); Don Julien, Certified Ballast Manufacturers; George Roscoe, NECA; Morton Silverberg, Silverberg Elec. Co; (standing—l to r)—Garlan Morse, Sylvania; C. E. Erb, Westinghouse Lamp Div; J. M. Waddell and W. M. Freudigman, IAEL; Richard Slauer, Sylvania; Ed Themak, G. E. Co., Large Lamp Dept; H. E. Cliff, Public Service Elec. & Gas Co; Franklyn Dickinson, Ohio Edison Co; and L. C. Messick, National Lighting Bureau.

NEW! Nightingale Wall Light

Gracefully Complements the Finest Furnishings
HOSPITALS DORMITORIES HOTELS MOTELS

Universally adjustable reading and examining light . . . separate indirect light for general illumination . . . subdued night light . . . convenient plug-in receptacle.

Double-walled reflector is thoroughly ventilated . . . can't burn fingers. Its unique, one-piece reverse-spun construction provides added strength . . . eliminates seams that may loosen or break apart.

Model No. 617

Adjustable FIXTURE CO.

104-108 E. Mason St.
Milwaukee 2, Wis.

Lighting

M & W MAST KITS

SPEED YOUR SERVICE ENTRANCE INSTALLATIONS

They're thrifty! M&W Kits contain every needed fitting for a quick, reliable wiring job. No lost time, no costly inventory. *They're fast!* Modern, time-saving slip-fittings are used throughout. With no thread-cutting, you reduce installation time to fractions. Complete range of sizes and fittings available to meet all local codes and conditions.

***NEW CATALOG 57** gives full details, prices, installation data on Mast Kits, Electrical Fittings, Cable Racks, Wiring Specialties. Write for your copy today.*

Complete-package Kits are furnished to your order and including fittings shown above.

M&W **Electrical Fittings**
The M. & W. ELECTRIC MFG. CO., Inc.
EAST PALESTINE, OHIO

costs are further reduced, it is now envisioned that dimming of all lighting circuits in the home will become practical. Small dimmer units would be located at the branch lighting circuit panel, and potentiometers would be located in the various rooms throughout the house in place of switches. Since only low voltage wiring is needed for the potentiometer circuits, this system for home lighting would be entirely practical and economical.

These new dimmers are also expected to make practical, and thus to popularize, greater lighting flexibility in stores, display rooms, restaurants, night clubs, and similar lighting applications.

All-Industry Group to Sponsor Relighting

The Eye-Fi Relighting program, developed and announced last year by the National Lighting Bureau of the National Electrical Manufacturers Association, is now under all-industry sponsorship. Action taken on December 2, 1958 at a meeting in New York City of representatives of all segments of the industrial and commercial lighting industry formalized this sponsorship, which had been developed and proposed by the National Lighting Bureau. The new program and sponsorship was approved by Certified Ballast Manufacturers Assn. (CBM), International Assn. of Electrical Leagues (IAEL), National Assn. of Electrical Distributors (NAED), National Electrical Contractors Assn. (NECA), National Electrical Manufacturers Assn. (NEMA), and Commercial Division Executive Committee of Edison Electric Institute (EEI). The operation of the National Lighting Bureau is also now under this new sponsorship, and the guidance of the newly formed all-industry Executive Committee.

The Eye-Fi Relighting program is designed to promote the tremendous market potential which relighting of business and institutional buildings offers to all branches of the electrical industry.

This huge relighting market is a result of the constant improvements in lighting techniques made to conform to modern business needs. The resulting new lighting methods and other improvements introduced in current building construction tend to make existing business places obsolete. Eye-Fi Relighting can inexpensively and effectively save many existing

buildings from such obsolescence.

Under the new all-industry sponsorship, a wide promotional effort will start early in 1959 to publicize Eye-Fi Relighting and what it can do for business. This campaign will dramatize the fact that adequate lighting means higher sales in stores, higher efficiency of production in plants and offices, higher levels of learning in schools.

Advertising to prospects, a part of the promotion, is expected to break in February and run in general news publications, and in trade publications of specific fields. An informative booklet on the benefits of relighting is being prepared, and will be merchandised through the advertising. It will also be distributed to relighting prospects by electric utilities, electrical contractors, and other local electrical groups.

Participating manufacturers will tie in with this program by affixing Eye-Fi Relighting tags to their fixtures, and Eye-Fi labels to their packages. Many are also planning to devote all or part of their own advertising to this program.

In those areas where lighting certification is established as a part of the original program of the National Lighting Bureau, it is possible to combine certification with the new Eye-Fi Relighting program, through the corollary concept of Certified Eye-Fi Relighting, according to NLB. All materials are being prepared so that they can be used with certification as an optional feature.

Cook County Contractors Elect Officers

William Veldhouse, Service Electric Co., was elected to serve his third term as president of the Cook County Electrical Contractors Association. Other officers chosen at the December meeting included George A. Rafel, G. A. Rafel & Co., vice president; A. L. Simons, Clark Electric Co., secretary; and Erwin Kaufmann, Kaufmann Electric Co., treasurer.

Members who will comprise the Board of Directors for the forthcoming year are: Joseph Kunst, Principle Electric Co.; Carl W. Sievert, Sievert Electric Co.; Joseph Turek, Avers Electric Co.; Irwin S. Marks, D. D. Electric Co.; Bernard Braverman, Almart Electric Co.; Howard M. Brown, Brown Electric Service; and Vito D. Signorile, Falson Electric Co.

WITH THOMPSON *Servisafe* POLES

Only five minutes required to replace burn-out on 30-foot pole!

Maintaining pole-mounted luminaires really is an easy job . . . with "Servisafe" Metal Poles. All work is accomplished at ground level with a "dead" fixture. As a result, one man can relamp and clean a luminaire with complete safety in any kind of weather. And the only "auxiliary" equipment required is a detachable handline!

Decorative as well as functional, "Servisafe" Poles feature unique advantages that assure peak lighting efficiency with minimum annual cost. Both single and double-arm models of steel or aluminum construction are available in heights up to 35 feet.

FOR SPECIFICATIONS AND PRICES, WRITE FOR BULLETIN PWB-59. 8310-TE

THE THOMPSON ELECTRIC CO.
P. O. BOX 873-D CLEVELAND 22, OHIO

MODEL
P-55-F

*FOR OUTDOOR CONSTRUCTION, INDUSTRY, FARMS, RANCHES, MOBILE HOME PARKS!

New!

WEATHERPROOF

***All-Purpose* "FUSED"**

POWER OUTLETS

MODEL P-55-F as illustrated, has a 60 amp. 250 volt, 4 wire power receptacle, protected with a two pole 60 amp. pull out block. Also has a grounded type duplex receptacle protected with a separate fuse. Top hub and bottom KO's facilitate overhead and underground connections. Completely weatherproof. Cover closes completely, when in use and can be padlocked. Also, Circuit Breaker Model P-55-C. . . . same as above with circuit breaker instead of fuse.

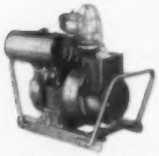
Over Seventy other standard models to choose from in fused or circuit breaker types with 15 to 60 amp. 3 and 4-wire receptacles.

REPRESENTATIVES: SOME EXCLUSIVE TERRITORIES SEE YOUR LOCAL ELECTRICAL ARE STILL AVAILABLE . . . WRITE DISTRIBUTOR OR WRITE . . .

Midwest ELECTRIC PRODUCTS, INC.
DEPT E MANKATO, MINNESOTA

PROFIT from portable job power
FOR USE BY YOU
...SALES TO OTHERS

Universal **electric plants**
of Oshkosh



Compact, hand-carried 1500-watt Universal.

Modern-design, 10 kw., air-cooled, gasoline-powered Universal.

Universal electric plants offer you a double-feature opportunity:

1. Save the time and bother of tapping in utility service. Have convenient, constant power for your residential and commercial work with a portable Universal. Low-cost models for all power tool and lighting needs.

2. Add Universal to your equipment line for extra profits. Supply the growing demand for portable and stand-by emergency power—to homeowners, hospitals, public buildings, construction contractors, etc. Universal is the full-range line with both gas and diesel series, air- and water-cooled from 250 watts to 35 kw. All types of controls.

SEE for yourself how the big, versatile Universal line can set you up for greater job efficiency and outside business. Write for this complete line bulletin of pictures, specs and information. It's Bulletin BE-6.

Universal Motor Co.
438 Universal Drive, Oshkosh, Wisconsin

HEART OF AMERICA meeting of NISA in Salina, Kansas, attracted, from left, Richard Wareham, president, Special Electric Co., Milwaukee, Wis.; L. McDowell, Mears Electric, Wichita, Kansas; Ben J. Horton, NISA director, Atkinson Armature Works, Pittsburg, Kansas; and Glen Proctor, Electric Service Co., Kansas City, Mo.

EEI Launches New Electric Living Program

The Edison Electric Institute has announced plans for a new $2.5 million promotion, for the year 1959, to promote 1) use of electric appliances, 2) improved wiring, and 3) better lighting in the nation's homes. This three-part program, according to J. E. Corrette, EEI President, "is designed to represent a rallying point for manufacturers and other trade allies in the electrical field to concentrate and coordinate their selling efforts in the residential market." It will be known as the National Electric Living Program.

Involved in this national EEI program are national magazine advertising, daytime network television, and point-of-sale merchandising, which will be used throughout the year. This nation-wide EEI promotional effort will, in turn, be reinforced on local, regional and national levels by electric light and power companies, appliance manufacturers, electrical distributors, electrical appliance dealers, electrical contractors and the lighting industry.

Part I of this three-part program will be devoted to selling more electric appliances in new and existing homes through the Appliance and Medallion Home program. Objectives are to 1) create an all-electric "climate" in the customer's mind, 2) sell the electrical advantages of all-electric products, 3) establish four basic selling "events" throughout the year, 4) build an easy-to-

support, industry-wide program, and 5) spearhead local action programs. To help achieve these objectives, EEI will carry 144 daytime network television commercials, over four eight-week periods (two in the spring, two in the fall), run full-color national magazine ads (in *Life* and *The Saturday Evening Post*), provide point-of-sale promotional materials for local programs, and do trade magazine advertising (*Home Furnishings Daily*, *Electrical Merchandising*, and *Mart*) to tell the story to allied industry groups, maintain enthusiasm, assist dealer coordination activities, and merchandise the national effort.

Part II of the EEI promotion will be devoted to selling more wiring capacity in new and existing homes, through the already existing HOUSEPOWER program, and national advertising. A series of spring and fall adds will run in four national consumer magazines, which will be supplemented by the National Wiring Bureau's program promoting the contractor as a "HOUSEPOWER Specialist". Continuing support is also anticipated from the National Association of Electrical Distributors, the National Electrical Contractors Association, and other industry allied groups.

As Part III of this program EEI will devote its efforts to selling more and better lighting in new and existing homes, through the Light for Living program. This activity will be in three phases. In the first phase is a competition for student architects, who will be asked to design a "Light for Living Medallion Home." In the second phase, adult consumers will compete in a series of local competi-

CHARTER of the new Quebec Chapter, third NISA organization in Canada, is presented to Paul Barbeau, Montreal Armature Works, chapter president, (right), by NISA national president Paul M. Sievert, of Sievert Electric Co., Chicago, and national vice-president H. C. Blenkhorn, of Blenkhorn & Sawle Ltd., St. Catharines, Ontario, Canada.

WITH GARCY "ULTRA-LUX"
Curved diffuser in 12" or 24" widths

OR 60TH ANNIVERSARY
Rectangular diffuser in 12" or 24" widths

It's a snap to install these Garcy fixtures. Only two basic parts to install, that's all. No on-the-job assembly work. End plates, diffuser panels and hinge fittings are all preassembled for you before shipment.

And Garcy fixtures are easy to handle. Even a lightweight like the gal above could handle these compact fixtures all day without tiring.

Find out for yourself how much on-the-job time you can save with Garcy fixtures.

Send for Bulletins 581-L and 582-L.

GARCY LIGHTING

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All the installation speed of Flexible Conduit . . . All the protection of Rigid Conduit . . . with

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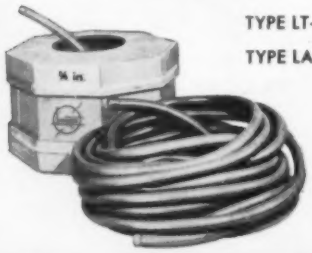
Extruded Polyvinyl Jacket Molded to Galvanized Flexible Conduit

Complete protection against any and all contamination—impervious to water, oils, chemicals, corrosive atmospheres. Installed in minutes. No more "down-time" due to wiring shorts or burn-outs, no more periodic wiring replacements.



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bends rigid or thinwall conduit with ONE frame!

TAL BENDER Set No. 2C-EMT combines everything needed for better on-the-job bends

You get everything needed for quick, smooth bending of 1" to 2" rigid and thinwall conduit up to 90° using the same frame. Set No. 2C-EMT includes basic 2" TAL BENDER, plus all shoes, bars, clamps and attachments, packed in sturdy wooden chest. High speed TAL BENDER MP-27 Motor Pump may be used for faster bending. Write for detailed Catalog No. 35, or see your electrical wholesaler for full information.

Hein-Werner CORPORATION
WAUKESHA, WISCONSIN

tions. The third phase will be devoted to a Teenagers' Contest, which will be conducted by local lighting dealers or electric utilities, and will not be promoted through schools.

Essex League Names New Officers

Charles E. Patterson, president of Buhl & Caffrey, electrical contractors, has been elected *president* of Essex Electrical League. Named with Patterson at the annual election luncheon recently were: *vice-president*, Joseph P. McCarthy, Graybar Electric Co; *treasurer*, Kenneth C. Larabee, manager, General Electric Co., lamp department; and *secretary*, Joseph A. Rockefeller, assistant commercial manager, Public Service Electric & Gas Co.

The following were elected to the executive committee: Joseph J. Feehan, manager, Westinghouse Electric Supply Co; Milton Nadelberg, secretary, Lightning Electric Service Co; William Winterton, Westinghouse Electric Corp., lamp division; Nat Eglowstein, president, General Lighting Products Co; and retiring League president, Elwood B. Johnson.

Sixteen past presidents of the league were honored at the luncheon, among them, Richard Hoe Osgood, the guest speaker, who is president of R. H. Osgood & Associates, Atlanta, Georgia. Other past presidents on the dais were: Granville H. White, Arthur L. Davis, James Hanbury, Raltph Morison, William A. Shaw, Arthur W. Lynn, Harold P. Litchfield, Edward J. White, Benjamin Golden, Thomas Hunter, Emil Heidt, Howard Snow, James Kennedy and Frank Sweeney.

LIVELY discussion at the Eastern Section IAEI meeting at Monticello, N. Y., was enjoyed by (L-R): Warren Nelson, electrical inspector, Poughkeepsie, N. Y.; George Bostley, N.Y.B.F.U., Albany, N. Y.; and Walter McNulty, sales engineer, Wehle Electrical Wholesalers, Binghamton, N. Y.

ACTIVE PARTICIPANTS in the Eastern Section IAEI meeting at Monticello, N. Y., were (L-R): Richard Lloyd, National Bureau of Standards, Washington, D. C.; William Deans, vice president, I.T.E. Circuit Breaker Company, Philadelphia, Pa.; and Merwin Brandon, NFPA and Underwriters' Labs.

NISA News

Demonstration of a bearing inserter and remover by its inventor, Ken Gibbs of Lipman Electric Co., Inc., Baltimore, Md., attracted a great deal of interest on the part of members of Quaker City Chapter at a recent meeting.

Mr. Gibbs' device eliminates reaming. It was described as "amazing" by former national president of NISA, Joseph H. Previty, of Penn Electric Motor Co., Philadelphia. Mr. Gibbs expects to market the product this year.

• • • •

Electrical equipment service shops that also manufacture had a chance to display their wares during the Tri-State meeting sponsored by NISA's Chicago Chapter on Nov. 21 at Hotel Graemere. Among the exhibitors were Sievert Electric Co. (motors), The Electric (rectifiers), Pluskota Electric (controls), Lewus Electric (relays) and Chicago Electric (transformers).

The all-day meeting attracted a large crowd of shop men and their wives. Tours of five Chicago shops were made by the men in the afternoon while the women were taken to Old Orchard Shopping Center. A dinner concluded the program.

• • • •

A tour of motor shops in Monterrey, Mexico, will be made by many of the members of Southwestern Chapter after the group's spring meeting in Brownsville, Texas, March 19-21. Handling arrangements are Bill Manning, Manning Electric Motor Service, Raymondville, Texas; Jim Corbell, Bradley's Electric, Inc., Harlingen, Texas;

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FOR YOUR B&D TOOLS

For genuine Black & Decker repairs check Yellow Pages under "Tools-Electric" for address of nearby Black & Decker

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Free tool inspection when requested • Genuine B&D parts used • Factory-trained technicians handle all work • Standard B&D Guarantee at completion of recommended repairs • Fast service at reasonable cost.

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QUALITY ELECTRIC TOOLS

POWER DISTRIBUTION TRANSFORMERS

DRY-TYPE DRI TRAN 3 KVA and UP

- Ultra quiet sound level construction
- To NEMA and ASA Specifications
- Impregnated cores and coils
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- Easily accessible terminal connections
- Additional overload safety factor is built-in by use of more than normal amount of core stock

750 KVA 3 PHASE

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Proof...

Sylvania Starters with ceramic condensers last longer!

According to actual field test—

Sylvania fluorescent starters with ceramic condensers had

only 1 failure out of 340 starters

Conventional starters with paper condensers had

51 failures out of 330 starters

Test was conducted over a two-year period in a manufacturing plant. Installations were Two-lamp, 40-watt industrial type fixtures.

Results like these prove that Sylvania starters with ceramic condensers give longer life and lower maintenance cost at no increase in price.

For details, call your Sylvania Representative.

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Lighting • Television • Radio • Electronics
Photography • Atomic Energy • Metallurgy

Carlos Ayala, Imperial Electric Motor Service, Brownsville, Texas; and Forrest Sparks, McAllen Armature Works, McAllen, Texas.

This planning committee met on November 15 with the chapter's executive secretary, Miss Ann Hickman, and secretary-treasurer Jim Morgan.

• • • •

The national headquarters of NISA has been receiving favorable comments from many of the chapter presidents and officers who attended the First Annual Chapter Officers Conference in St. Louis last October. The organization plans to hold a similar meeting in the fall.

• • • •

NISA's board of directors held its mid-year meeting in Cleveland, Ohio, in November at Hotel Cleveland. The group toured plants of Lincoln Electric Co. and Reliance Electric and Engineering Co. and was entertained by the firms at a dinner at the Cleveland Engineering Society.

• • • •

A new portable exhibit will be displayed for the first time by the Association at its booth at the Plant Maintenance and Engineering Show in Cleveland, January 26-29. Members of NISA's Greater Cleveland Chapter will be in charge of arrangements.

• • • •

A former NISA national president has retired and closed his shop in Windsor, Ont. Robert B. Turner, president of Johnson-Turner Electric Repair & Engineering Co., Ltd. announced the closing on November 15. He also said that the Sarnia, Ont., branch would remain open under a reorganized management.

CODE CLINIC sessions at the Eastern Section IAEI meeting at Monticello, N. Y., were well attended by members, including (L-R): Herman Metz, construction superintendent, Cucinell Electric Company, Yonkers, N. Y.; John Doris, John Doris Inc., New York, N. Y.; and Robert Rockford, chief inspector of Bronx, N. Y., for Con Edison.

Latrobe *Electrical* Products

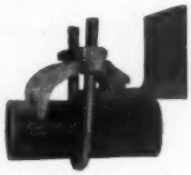
The ease and speed with which "Latrobe" Products are installed cut time and labor costs substantially.

The same directness of design that makes for these fast installations also helps assure smooth, trouble-free service

Two Gang Adjustable Floor Box

Adjustable Boxes come in single-round or square bodies. Also in square type Single Gang, Two Gang, Three Gang and Four Gang Boxes. All adjustable boxes are now bonded which makes them fire-proof.

"Latrobe" Pipe or Conduit Clamp



This clamp is made with a double safety bite of case hardened tool steel. Two models—Right Angle and the Parallel support. Each model comes in 10 sizes to handle pipe or conduit ½" thru 4".

Insulator Supports

Malleable iron clamps of high tensile strength. Four sizes to fit all standard porcelain or glass insulators.

Sold Only Thru Wholesalers

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Non-Adjustable Floor Boxes
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Cable Supports . . . Fish Wire
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Write for new catalog

Sales Representatives in all principal cities.

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LATROBE, PA.

CONFERRING about NISA convention in Montreal recently were, from left: Arthur G. Bamford, Sutherland-Schultz Electric Co., Ltd., Kitchener, Ontario; NISA national president Paul M. Sievert, Sievert Electric Co., Chicago; and Ross Sawle, Blenkhorn & Sawle, Ltd., St. Catharines, Ontario.

Another NISA member shop has changed hands. The Johnson Electric Co. of Staunton, Va., has been bought by its assistant manager, Carl Argenbright, and Neal Chapman, of Pass-a-Grille, Fla. Owner Goodwin Johnson has retired.

• • • •

Another in a series of pre-convention meetings was held in Toronto, Ont., on January 17 by members of the International Convention planning group, including general chairman D. D. Bishop, of Montreal Armature Works, Montreal, P. Q.; C. J. Ainsworth, Ainsworth Electric Co., Toronto, Ont.; H. C. Blenkhorn, of Blenkhorn & Sawle, Ltd., St. Catharines, Ont.; Joseph M. Harrington, of St. Louis, the NISA executive vice-president; and Horace Barks, of Horace Barks Publications, St. Louis, the NISA publicity counsel.

The International Convention of NISA will be held in Montreal at Hotel Queen Elizabeth on May 17-20. It will be the first convention of the electric service industry to be held in Canada.

• • • •

Wurth Electric Co., of New York City, has moved to new quarters at 75-20 Jamaica Avenue, Woodhaven 21, New York.

IES-AIEE-AIA Joint Meeting on Lighting

Lighting of the U. S. Pavilion and Theatre at the Brussels World's Fair was discussed by those responsible for it at a recent joint meeting of the Illuminating Engineering Society, the Illumination Division of the American Institute of Electrical Engineers, and

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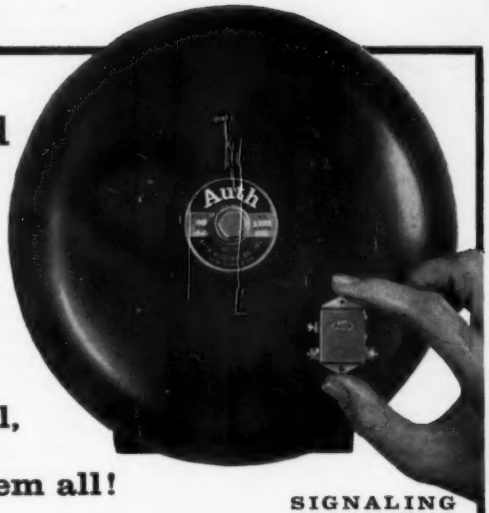

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the American Institute of Architects, in New York City.

Harry Turko, architectural coordinator for the office of Edward D. Stone in the building of both the U. S. Pavilion and Theatre, represented AIA. "Quality, not merely footcandle value, is important in illumination," he stated. "Architects are beginning to realize the possibilities in their use of light, and in the future will undoubtedly plan for and control it much more than in the past." Mr. Turko described the design features of the U. S. Buildings at the Fair, and how the lighting design was integrated with the building design for specific visual results, and by means of slides showed how these results were obtained.

Present trends in lighting need better direction, for there is too great an emphasis on just high levels of illumination, Rollo G. Williams, representing the IES, told the group of architects and lighting engineers. Mr. Williams is director of color research and lighting consultant with Century Lighting, Inc., and was lighting consultant for the U. S. Pavilion at the Fair. He further stated that "light is useful not only for dispelling darkness but also for determining what is to be seen, the way it is to be seen, and the color in which objects are to appear. Lighting should be considered by architects as a material and a basic element of design." He described the various lighting techniques and lighting design treatments used in the Pavilion, and showed by slides how the various areas appeared at night.

Stanley McCandless, professor of lighting at Yale University and lighting consultant with Century Lighting, Inc., and representing IES and AIEE, told the group that architects are beginning to realize that lighting is their problem. "The more they realize that fact, the more they will integrate it as a part of their basic design, and the more they will call on the excellent technical help now available in the lighting field," he said.

As lighting consultant for the United States Theatre at the Fair, Mr. McCandless used a grid of low-wattage silver bowl lamps behind the plastic mesh walls of the building to give a pin-cushion effect. Reflector floods were suspended from the ceiling above the plastic mesh so that they shone down through on the seating area. For the exterior of the building a curtain of light was used at night behind the light, airy grill.

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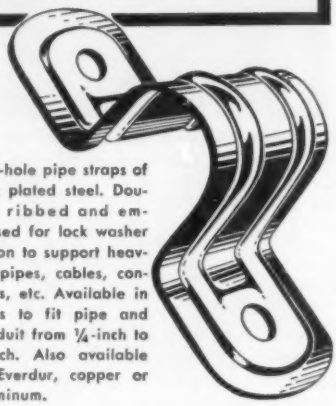

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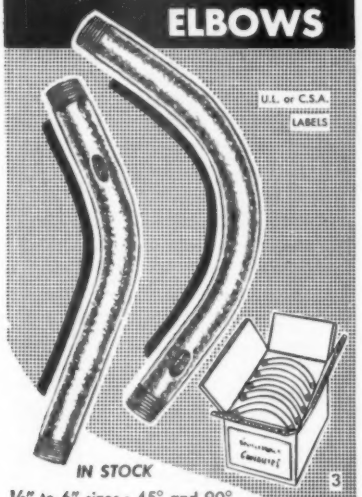

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Industrial Heating Equipment Assn.— Annual winter meeting, Hotel Cleveland, Cleveland, Ohio, January 19-20.

Power & Communications Contractors Assn. — Shamrock Hilton Hotel, Houston, Texas, January 25-27.

Plant Maintenance & Engineering Show—Public Auditorium, Cleveland, Ohio, January 26-29.

14th International Heating & Air Conditioning Exposition — Commercial Museum & Convention Hall, Philadelphia, Pa., January 26-29.

American Institute of Electrical Engineers — Winter general meeting, Hotel Statler, New York, N. Y., February 1-6.

Home Improvement Products Show— Coliseum, New York, N. Y., February 4-6.

National Electrical Week — An all-industry event, February 8-14.

National Rural Electric Co-op Assn.— National Guard Armory, Washington, D. C., February 9-12.

Electric Associates, Inc. — National Electrical Week luncheon, Sheraton-Astor Hotel, New York, N. Y., February 10.

2nd Biennial Electrical Trade Conference & Exposition — Sponsored by Electrical Trade Institute of Washington, Sheraton Park Hotel, Washington, D. C., February 17-18.

Upper Midwest Electrical Industry Convention — Leamington Hotel, Minneapolis, Minn., February 22-25.

15th Annual National Wiring Sales Conference—Jung Hotel, New Orleans, La, February 26-27.

2nd National Lighting Exposition— Coliseum, New York, N. Y., March 1-4.

Industrial Electrical Exposition—Sponsored by Essex Electrical League, National Guard Armory, Elizabeth, N. J., March 10-12.

Edison Electric Institute — Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 8-12.

American Power Conference — Sponsored by Illinois Institute of Technology in cooperation with some 14 colleges and technical societies, Hotel Sherman, Chicago, March 31 and April 1-2.

Edison Electric Institute—Annual Convention, New Orleans, La., April 5-9.

Progress in Electrical Equipment— Kiel Auditorium, St. Louis, Mo., April 7-9.

National Association of Lighting Maintenance Contractors—Annual conference, Cosmopolitan Hotel, Denver, Colo., April 27-29.

National Industrial Service Assn. — Queen Elizabeth Hotel, Montreal, Canada, May 17-21.

National Fire Protection Assn.—Annual meeting, Atlantic City, N. J., May 25-29.

National Association of Electrical Distributors—51st annual convention, Conrad Hilton Hotel, Chicago, Ill., May 24-29.

New York State Association of Electrical Contractors and Dealers — 60th Annual convention, Whiteface Inn, Lake Placid, N. Y., July 7-10.

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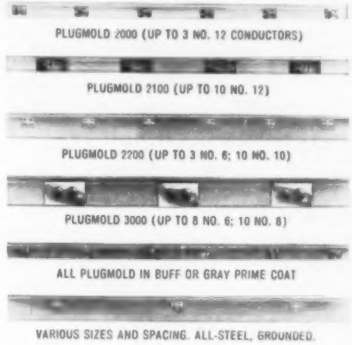
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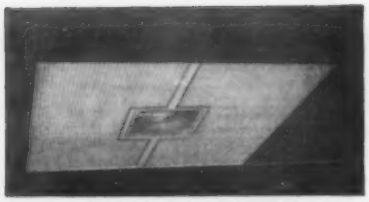

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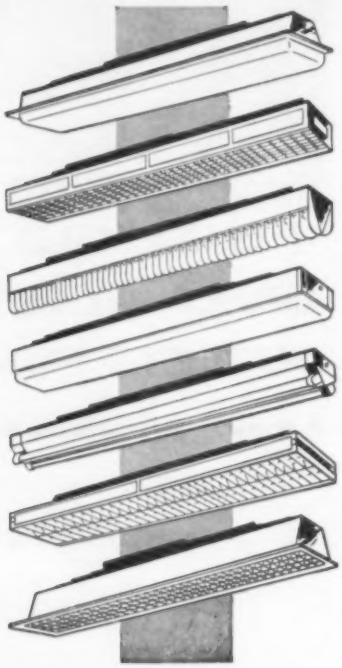

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Headquarters Announcements

I-T-E Circuit Breaker Co., Philadelphia, has acquired the **Wilson Electrical Equipment Co., Inc.**, of Houston, Tex., which will operate as a wholly-owned subsidiary.

Federal Pacific Electric Co., Newark, N. J., has acquired **Cemco Holdings, Ltd.**, Vancouver, B. C., manufacturers of medium and high voltage distribution and control equipment.

Thomas Industries, Inc., Louisville, Ky., has acquired the **Benjamin Electric Mfg. Co.**, Des-Plaines, Ill., which will be operated as a division.

Kaiser Aluminum & Chemical Corp., Chicago, Ill.—J. S. Urbanik, manager of plant operations, Electrical Conductor Div.

Progress Mfg. Co., Inc., Philadelphia, Pa.—Will Turner, director of sales; William T. Steele, national sales manager.

Rodale Mfg. Co., Emmaus, Pa.—Elmer A. Barto, president; J. I. Rodale, chairman of the board; Jacob Schmier, vice president in charge of production; Jack Kushner, vice president in charge of sales.

Carrier Corp., Syracuse, N. Y.—Karl Gerteis, manager of development engineering department; Maurice J. Wilson, sales manager of commercial air conditioning; Burton T. Kehoe, sales manager of packaged air conditioning equipment — all with Unitary Equipment Div.

Allis-Chalmers Industries Group, Milwaukee, Wis.—J. T. Graham, supervisor of sales training.

Electric Storage Battery Co., Philadelphia, Pa. — Monroe G. Smith, vice president; J. A. McIlnay, vice president in charge of marketing; C. J. Moore, general sales and marketing manager, Exide Industrial Div.

BullDog Electric Products Co., Detroit, Mich.—George A. Fassnacht, manager, duct systems.

Morrison Steel Products, Inc., Buffalo, N. Y.—Isadore Morrison, president; M. Jacque Kohnstamm, executive vice president.

Gulton Industries, Inc., Metuchen, N. J.—James G. Hamelin, advertising and public relations manager.

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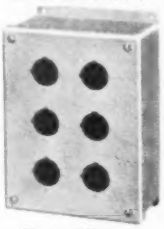

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Bennet Associates, Inc., Pittsburgh, Pa.—D. W. Rice, manager of conduit and tubular materials.

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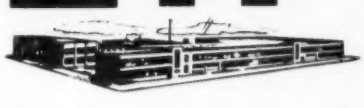

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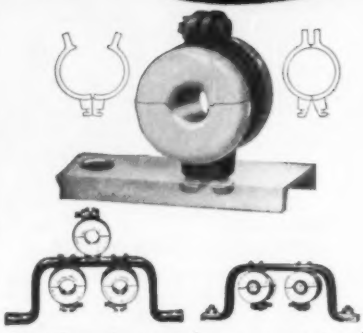

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WEST

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Arrow Conduit & Fittings Corp. and Arrolet Corp.: Suchman Associates, sales representatives in California, office in Los Angeles.

Pfaff & Kendall: Forrest E. Pope, Burlingame, Calif., Western Sales Manager.

Grip-Tite Mfg. Co.: Jim Raney, R & M Sales Co., representative in Colorado and Wyoming.

Allis-Chalmers Industries Group: Allan L. Short, Northeast Regional Representative for distribution and transmission equipment.

Hitemp Wires, Inc.: Robert Martin, West Coast regional sales manager, for states of Arizona, California, Oregon and Washington.

Quadrangle Mfg. Co.: William O. Proby & Associates, Inc., Seattle, representatives for Alaska, Washington, Oregon and Idaho.

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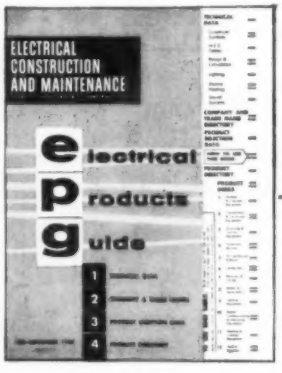

• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

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***GET THE COMPLETE STORY** on certified fuseless fault protection for high-voltage motor drives. Write for Bulletin 8130*

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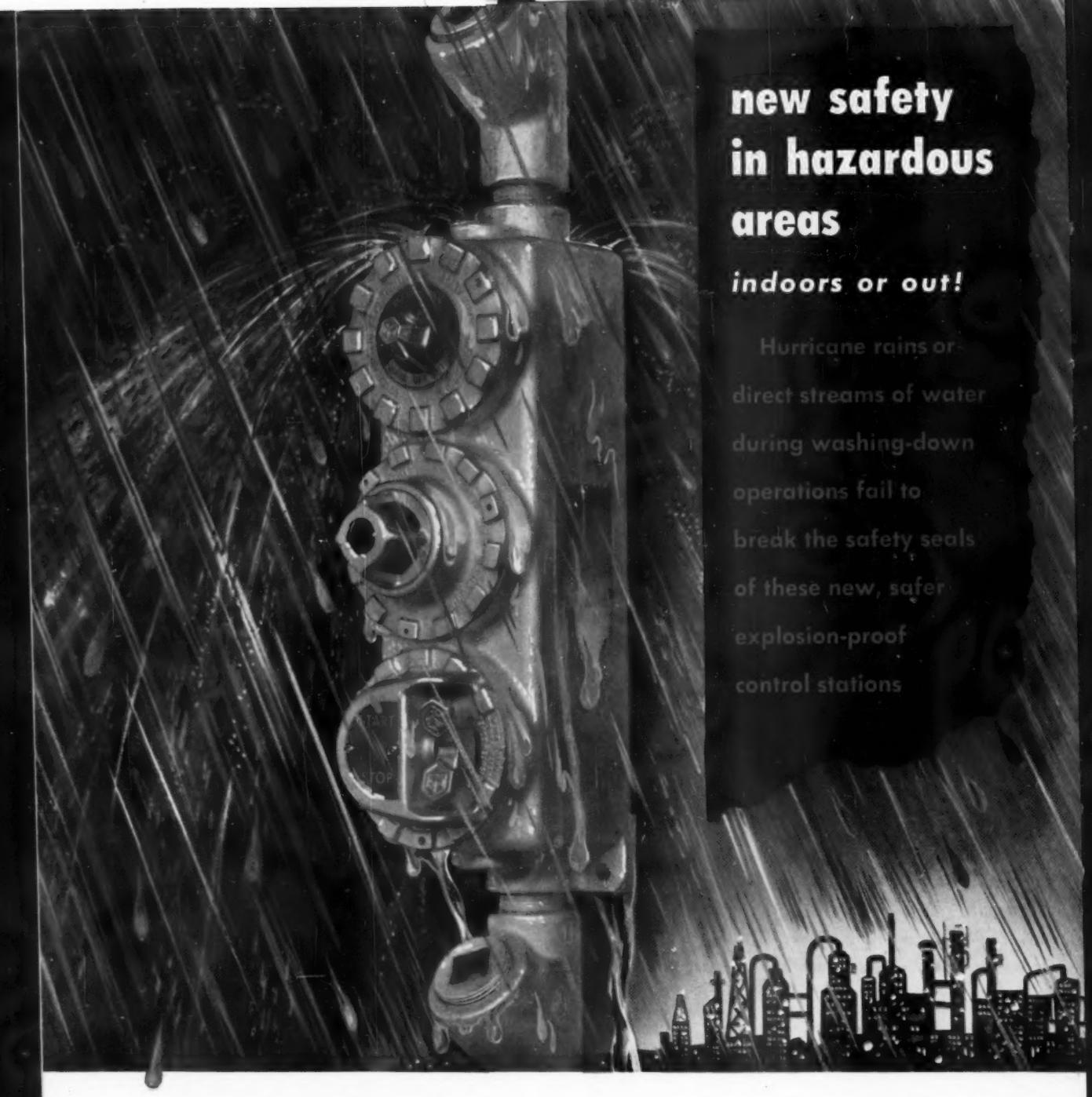

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CROUSE HINDS

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